NA-50-1277

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NORTH AMERICAN AVIATION INC

ESTIMATED AERODYNAMIC CHARACTERISTICS

FOR

DESIGN OF THE

F-86E AIRPLANE

FC

File No. Report No. NA-50-1277

NORTH AMERICAN AVIATION, INC.

ENGINEERING DEPARTMENT

ESTIMATED AERODYNAMIC CHARACTERISTICS FOR DESIGN OF THE F-86E AIRPLANE

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No. of Pages 82

Date 12-26-50

REVISIONS

DATE	REV. BY	PAGES AFFECTED	REMARKS

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INTRODUCTION

This report is a compilation of aerodynamic data for design of the F-86E airplane. The aerodynamic coefficients presented herein are based on wind tunnel tests conducted in the North American Aerodynamics Laboratory 7.75 x 11 foot low speed wind tunnel and in the high speed Southern California Cooperative Wind Tunnel. NACA experimental results are also utilized.

This report was prepared by F. T. Gardner and H. T. Downey under the supervision of W. E. Swanson.

W. E. Swanson
Basic Data Section

SUMMARY

Estimated aerodynamic characteristics of the F-86E airplane have been compiled herein for the purpose of furnishing a resume of design data. This report is in effect an appendix* to the aerodynamic report on the F-86A airplane since the principal difference between the F-86A and the F-86E which affects the aerodynamic characteristics is the incorporation of an all-movable horizontal tail.

The major portion of the information presented has been divided into sections of airplane longitudinal, lateral, and directional characteristics; the final sections are composed of fuel tank force data and slat load characteristics. Included in the longitudinal section are tail-off and tail-on lift and pitching moment, stabilizer and elevator effectiveness, stabilizer and elevator hinge moments, the effect of speed brakes, and the effect on airplane drag and pitching moment of the external under-wing fuel tanks. Lateral characteristics include the effect of aileron on lift, pitching moment and rolling moment. Aileron hinge moments and panel rolling moment complete the lateral section. The directional section consists of rudder hinge moment as a function of angle of yaw.

* For convenience the data of the F-86A airplane report (NA-48-814), which is applicable to both the F-86A and F-86E airplanes, have been reproduced herein such that the complete airplane characteristics of the F-86E are available in this one report.

DISCUSSION

GENERAL

The aerodynamic characteristics in this report have been presented as airplane coefficients which are defined by the nomenclature of Table II and by the dimensional data of Table I. This report is effectively an appendix to the aerodynamic characterisitcs report on the F-86A airplane, reference (a), since the principal aerodynamic difference between the F-86A and the F-86E is due to the difference in horizontal tails. The F-86E stabilizer serves as the primary longitudinal control and is operated by motion of the control column. The elevator is connected to the stabilizer by differential linkage so that the net effect is an all-moving horizontal tail. The F-86A stabilizer, however, is used only as a trimming device with the elevator acting in the conventional manner as the primary longitudinal control.

The data in this report are applicable only to a rigid airplane; therefore suitable modifications must be applied to include aero-elastic effects.

LONGITUDINAL CHARACTERISTICS

1. Tail-Off Lift, Drag, and Pitching Moment

Tail-off lift and pitching moment coefficients, slats closed, are presented in figure 4 for a Mach number range of M = .20 to 1.20. The effect of slats on lift and pitching moment is shown in figures 5 and 6 for the configurations of wing plus fuselage and wing in the presence of the fuselage. The tail-off drag polar, clean configuration, appears in figure 7 for M = .20 to M = 1.20. Figure 8 presents the drag of the fuselage in the presence of the wing, from which $C_{D_{W(B)}}$ can be calculated since $C_{D_{W(B)}} = C_{D_{W+B}} - C_{D_{B(W)}}$.

All tail-off data as listed above are reproduced from reference (a).

2. Tail-On Lift and Pitching Moment

Figure 9 presents tail-on lift and pitching moment for the Mach range of M = .20 to 1.20. These data are also reproduced from reference (a).

Pitching moment coefficients are taken about a center of gravity located at fuselage station 188.52

DISCUSSION

LONGITUDINAL CHARACTERISTICS

2. Tail-On Lift and Pitching Moment (Cont.)

(.25 M.A.C.), water plane -12.23, and buttock plane zero. It should be noted that tail-on pitching moment data are for a stabilizer setting of +1°.

Estimated limit trim lift coefficients versus Mach number for slat closed and open and for abrupt and gradual stalls are shown in figure 10. In figures 4 through 7 and 9 the limit lift coefficients for which data are shown are not correct for Mach numbers less than .60. The revised limit trim lift coefficients shown in figure 10 were used in the design of the airplane primarily because they were predicated upon flight test data of references (u) and (v).

3. Horizontal Tail Data

In addition to the difference already noted (General Discussion), the F-86E horizontal tail is designed with the elevator hinge line at the 72% chord element instead of the 67% chord element as it was for F-86A elevator. Moving the hinge line aft 5% of the horizontal tail chord reduced the elevator area but the nose of the elevator remained at essentially the same horizontal tail element thus the F-86E has an aerodynamic balance of the overhanging type. The static horn balance that was located near the tip of the horizontal tail has been removed and a new static balance, distributed internally along the nose of the aerodynamic balance, has been added. The trailing edge strip that was installed on the F-86A elevator has been removed from the F-86E. Figure 11 presents the rate of change of the elevator hinge moment coefficient with stabilizer deflection, $dC_{H_e}/d\delta_s$, versus Mach number. The variation of stabilizer hinge moment with elevator deflection, $C_{H_s}(\delta_e)$ is shown in figures 12 and 13. The rate of change of stabilizer hinge moment with stabilizer deflection, $dC_{H_s}/d\delta_s$, versus Mach number appears in figure 14. Figures 15 through 18 present the variation of stabilizer hinge moment with elevator deflection, $C_{H_s}(\delta_e)$. The data of figures 11 through 18 are based on references (e), (f), and (g).

Stabilizer effectiveness, figure 19, is based on references (e), (g), (l), and (m). Elevator effectiveness in the form of increments of airplane pitching moment at constant angles of attack due to elevator deflection, appears in figures

DISCUSSION

LONGITUDINAL CHARACTERISTICS

3. Horizontal Tail Data (Cont.)

20 through 22. These data are predicated on references (e), (g), (l), and (p). Figure 23 presents the stabilizer-elevator gearing curve. Inasmuch as the effectiveness of an all-movable horizontal tail is such that it requires a high degree of accuracy in manufacture and rigging that is difficult to produce, a tolerance of ±1° elevator deflection is shown.

4. Speed Brake Effects

Increments in airplane pitching moment and drag due to deflection of the fuselage speed brakes, figures 24 through 27, are reproduced from the F-86A report, reference (a). It should be noted that the maximum speed brake deflection for the F-86E is 50° (see table I).

5. External Wing Fuel Tank Effects

Figure 28 presents the estimated increment in drag of the airplane due to one 120 gallon external wing fuel tank with fin for zero airplane angle of attack. The variation of $d\,\Delta C_m/dC_L$ with Mach number is shown in figure 29. These data have resulted from an analysis of references (c), (d), (o), (r), (s), and (w). The location of the under-wing tank is at Buttock Plane 99.5.

LATERAL CHARACTERISTICS

Increments in lift, pitching moment, and rolling moment due to aileron deflection will be found in figures 31 through 44. Longitudinal and lateral center of pressure locations of the increment of wing load due to aileron deflection versus Mach number are presented in figure 30. The data of reference (b), (i), (l), and (m) were utilized in deriving the above information.

Aileron hinge moments, figures 45 and 46, are based on the data of references (i), (m), (q), and (a-2).

Panel rolling moment as a function of airplane angle of attack for the two configurations of wing plus fuselage and wing in the presence of the fuselage are reproduced from reference (a). Slats closed data appear in figure 47, while slats free data are given in figure 48.

DISCUSSION

LATERAL CHARACTERISTICS (Cont.)

For convenience, the average pressure coefficients measured in the aileron paddle balance chamber are included in this report in figures 49 through 52. These data are based on the information of references (i), (n), (o), (p), (q), (t), and (x).

DIRECTIONAL CHARACTERISTICS

The variation of rudder hinge moment due to both yaw and rudder deflection are presented at various Mach numbers in figures 53 and 54. Figure 55 presents the increment in rudder hinge moment due to angle of attack, throughout the range of yaw angles. These data are based on references (g) and (h).

TANK CHARACTERISTICS

Yaw data for the 120 gallon external wing fuel tank with large fin, located at Buttock Plane 99.5, are presented in figures 56 through 58. Tank normal force coefficient, C_N, and C_N x C.P. versus angle of yaw for various angles of attack and Mach numbers will be found in Figure 56.

Tank side force coefficient and the corresponding center of pressure versus angle of yaw for various airplane angles of attack and Mach number are presented in Figure 57. Figure 58 presents tank support fairing side force section data.

All tank data are predicated on the data of reference (j), (y), and (z).

SLAT LOAD CHARACTERISTICS

A table of retracted slat load characteristics at various Mach numbers and angles of attack is presented in figure 59. Included in this figure is a complete definition of the forces and moment arms involved.

The slat opening force coefficient, C_s, versus angle of attack for various Mach numbers is presented in figure 60.

All slat data are based on the tunnel tests of reference (k).

REFERENCES

(a) NA-48-814 "Estimated Aerodynamic Characteristics for Structural Design of XP-86 and P-86A Airplane", dated 21 July, 1948

(b) NA-48-835 "Estimated Aerodynamic Characteristics for Structural Design of the YF-93 Airplane", dated 25 October 1948

(c) NA-49-797 "Revised Performance Calculations for the Model F-86A Airplane", Appendix I, dated 31 October 1949

(d) NA-49-1045 "Estimated Aerodynamic Characteristics for Design of B-45 Airplane", dated 21 November 49

(e) NA-46-852 (NAAL-46) "Wind Tunnel Tests of a 0.23-Scale Model of the XP-86 Airplane with a 5 Aspect Ratio Sweptback Wing", dated 11 November 1946

(f) NA-46-969 (NAAL-55) "Wind Tunnel Tests of an 0.23-Scale Model of the XP-86 Airplane to Determine the Slats Open Flying Qualities", dated 15 October 1946

(g) NA-47-1043 (NAAL-84) "Wind Tunnel Tests to Determine the Low Speed Flying Qualities of a 0.20-Scale High Speed Model of the XP-86 Airplane", dated 26 October 1947

(h) NA-48-351 (NAAL-99) "Wind Tunnel Tests of a 0.20-Scale Model of the P-86B Airplane with an Enlarged Horizontal Tail and Revised Speed Brakes", dated 17 March 1948

(i) NA-49-467 (NAAL-142) "Wind Tunnel Tests to Determine the Stability and Fuselage Pressure Distribution of a 0.20-Scale Model of the F-93A Airplane"

(j) NA-49-1027 (NAAL-154) "Wind Tunnel Tests of a 1/3-Scale Semi-Span Model of the F-86A Airplane to Determine Force and Pressure Characteristics for Three 120 Gallon Wing Fuel Tanks", dated 16 November 1949

REFERENCES

(k) CWT-23 "Preliminary Report on High Speed Wind Tunnel Tests of a 1/3-Scale Half Model of the North American XP-86 Airplane", dated 23 September 1947

(l) CWT-38 "Preliminary Report on High Speed Wind Tunnel Tests on a 0.20-Scale Half Model of the P-86B Airplane", dated 20 January 1948 through 1 March 1948

(m) CWT-52 "Preliminary Report on Wind Tunnel Tests at Transonic Speed of Several Proposed 1/40-Scale Models of the North American F-86B and F-86C Airplanes", dated 19 November 1948

(n) CWT-54 "Preliminary Report on Additional High Speed Wind Tunnel Tests of an 0.08-Scale Model of the North American XAJ-1 Airplane", dated 6 August 1948

(o) CWT-98 "Report on Wind Tunnel Tests at High Speeds and High Reynolds Numbers of a 0.115-Scale Reflection-Plane Model of the North American XA2J-1, Phase 1 Airplane", dated 26 April 1949

(p) CWT-110 "Report on Wind Tunnel Tests at High Speeds and High Reynolds Numbers of a 1/5-Scale Refelction-Plane Model Incorporating Various Components of the North American F-86 and YF-93 Airplane", dated 12 August 1949

(q) CWT-130 "Report on Wind Tunnel Tests at High Speeds of a 1/5-Scale Reflection-Plane Model of the North American F-86 and YF-93 Airplane", dated 12 August 1949

(r) RM-L9J19 (NACA) "The Effect of Tip Tanks on the Rolling Characteristics at High Subsonic Mach Numbers of a Wing Having an Aspect Ratio of 3 with a Quarter-Chord Line Swept Back 35°", dated 17 January 1950

(s) RM-L9K25 "Experimental Investigation of Various External-Store Configurations on a Model of a Tailless Airplane with a Sweptback Wing", dated 19 January 1950

REFERENCES (Cont.)

(t) RM-L8H06 "Pressure Distributions Over a Wing-Fuselage Model at Mach Numbers of .4 to .99 and at 1.2", dated 3 November 1948

(u) RM-A8130 "The Effect of Change of Angle of Attack on the Maximum Lift Coefficient of a Pursuit Airplane", dated 6 May 1949

(v) CMR-A5G06 (NACA) "Effect of Mach and Reynolds Numbers on Maximum Lift Coefficient in Gradual and Abrupt Stalls", dated July 1945

(w) Technical Report F-TR-1188-IA(ATI No. 43187) "Compressibility Effects on Drag--Air Drag: Theoretical and Practical Data on Aerodynamic Drag"

(x) NACA-PC #5.36/5 "High Speed Wind Tunnel Tests of a 1/4 Scale Model of the XP-81 Airplane -- Aileron Hinge Moment and Balance Pressures", dated 25 January 1945

(y) TM-1194 (NACA) "Force and Pressure Distribution Measurements on Eight Fuselages"

(z) Archives Report No. 66/120 (German Report) "Three Component Measurements on 15 Cm. Shell Shapes 1 and 5"

(a-1) NA-50-928" Aerodynamic Dimensional Data for the F-86E Airplane (N.A.A. Model Designation NA-170)", dated 30 August 1950

(a-2) Flight Test Data, Flight 19, F-86A, No. 49-1067

TABLE I

AERODYNAMIC DIMENSIONAL DATA*

WING DATA

S_w	Total wing area (includes flaps, slats, and 49.92 ft.^{2} covered by the fuselage)	287.95 ft.^{2}
b_w	Span (horizontal)	37.12 ft.
AR_w	Aspect ratio	4.785
λ_w	Taper ratio $\frac{1}{1.949}$	.5131
Γ_w	Dihedral angle	3°00'
$\bar{c}_w$	Mean aerodynamic chord (wing sta.98.71) Fuselage sta. of .25 $\bar{c}_w$ (W.P.-25.63)	97.03 in. 188.52
φ_w	Sweepback of the 25% element(aerodynamic)	35°13'31.4"
i_r	Incidence of the root chord (sta.0)	+1°00'
i_t	Incidence of the tip chord (sta.220.8)	-1°00'
	Root airfoil(normal to 25% element)	NACA 0012-64 (modified)
	Tip airfoil(normal to 25% element)	NACA 0011-64 (modified)

* From Reference (a-1)

TABLE I (Cont.)

AERODYNAMIC DIMENSIONAL DATA

AILERON DATA (Data for one aileron)

Type		Flat Sided
S_a	Area (aft of aileron hinge line and including aileron tab)	16.36 ft^2
$S_a \bar{c}_a$	Area moment	26.49 ft^2
c_a/c_w	Ratio of aileron chord to wing chord (in streamline)	.3081
$\delta_{a_{max}}$	Aileron deflection, maximum	15°up,15°down
S_b	Balance area forward of the hinge line (including 50% of the fabric seal = .701 ft^2)	6.43 ft^2
c_b/c_a	Ratio balance chord to aileron chord	.4390

LEADING EDGE SLAT DATA (for one side only)

S_{sl}	Area, projected into wing ref. plane	17.72 ft^2
b_{sl}	Span (Wing Sta.54.09 to 209.33)	155.24 in.
C_{sl}	Chord (constant)	16.43 in.
δ_{sl}	Deflection	15°00'

HORIZONTAL TAIL

Type	Stabilizer adjustable from cockpit control column; elevator connected to stabilizer by differential linkage	
S_H	Total area (including 1.20 $ft.^2$ covered by vertical tail)	35.28 ft^2
b_H	Span	12.75 ft^2
AR_H	Aspect ratio	4.65
λ_H	Taper ratio	.450

TABLE I (Cont.)

AERODYNAMIC DIMENSIONAL DATA

HORIZONTAL TAIL (Cont.)

Γ_H	Dihedral angle	10°
$\bar{c}_H$	Mean aerodynamic chord (H.T.Sta.33.54) Fuselage station of .25 $\bar{c}_H$(W.P.20.70)	34.71 in. 406.01
φ_H	Sweepback of the 25% element	34°35'20"
$\frac{S_H}{S_W}$	Ratio horizontal tail area to wing area	.1225
	Airfoil Sections (Root and Tip, parallel to ℄)	NACA 0010-64
δ_s	Deflection of stabilizer with respect to the fuselage reference plane	10°down, 6°up
S_e	Area (excluding balance area forward of the hinge line)	8.62 ft^2
$S_e\bar{c}_e$	Area moment (normal to hinge line)	6.07 ft^3
c_e/c_H	Ratio of elevator chord to horizontal tail chord	.2800
δ_e	Deflection maximum (measured with respect to horizontal stabilizer chord plane and normal to elevator hinge line)	20°54'up 8°20' down

VERTICAL TAIL DATA

S_v	Area (including .92 $ft.^2$ blanketed by the fuselage and excluding 3.96 ft.2 dorsal fin)	33.44 $ft.^2$
AR_v	Aspect ratio	1.74
λ_v	Taper ratio	.362
$\bar{c}_v$	Mean aerodynamic chord (V.T.Sta.37.87)	55.99 in.
	Fuselage station of 25 c_v(W.P.54.59)	385.78
φ_v	Sweepback of 25% element	35°

TABLE I (Cont.)

AERODYNAMIC DIMENSIONAL DATA

VERTICAL TAIL DATA

	Airfoil (parallel to fuselage reference plane, constant)	NACA 0011(10) -64 modified
S_r	Area (including tab but excluding rudder balance forward of hinge line)	8.12 ft^2
$S_r \bar{c}_r$	Area moment	9.72 ft^3
δ_r	Deflection, maximum	27.5°R, 27.5°L

SPEED BRAKE DATA

$\delta_{j_{max}}$	Speed brake deflection, maximum	50°
S_j	Area (surface area of one brake)	5.49 ft^2

TAPLE II

NOMENCLATURE

GENERAL NOMENCLATURE

M: Free stream Mach number = $\frac{V}{a}$

V: Average free stream velocity, ft./sec.

a: Velocity of sound in air, ft./sec.

α: Angle of attack of fuselage reference line relative to the free air stream, degrees

ψ: Angle of yaw of plane of symmetry relative to the free air stream, degrees

q: Incompressible dynamic pressure of free stream= $\frac{\rho V^2}{2}$

ρ: Mass density of air, slugs/ft^3

$\frac{p}{q}$: Difference between local static pressure and free stream static pressure divided by free stream incompressible dynamic pressure

S: Wing area projected in wing reference plane, ft.^{2}

S_{aft}: Area of movable surface aft of hinge line, ft.^{2}

$\bar{c}$: Mean aerodynamic chord, in.

$\bar{c}_{aft}$: Mean aerodynamic chord of movable surface, in.

b: Wing span, ft.

AIRPLANE NOMENCLATURE

W = Wing

B = Fuselage

S = Slats

S_f = Slats free

W(B) = Wing in the presence of fuselage, slats retracted

B(W) = Fuselage in presence of wing, slats retracted

H = Horizontal tail

V = Vertical tail

TABLE II

NOMENCLATURE (Cont.)

AIRPLANE COEFFICIENTS

C_L = Lift coefficient = $\frac{\text{Lift}}{qS}$

C_D = Drag coefficient = $\frac{\text{Drag}}{qS}$

C_m = Pitching coefficient = $\frac{\text{Pitching Moment}}{q S \bar{c}}$

$C_\ell{}'$ = Panel rolling moment coefficient (due to lift on one wing only) = $\frac{\text{Panel Rolling Moment}}{q S b}$

C_ℓ = Airplane rolling moment coefficient due to deflection of one aileron $\frac{\text{Airplane Rolling Moment}}{q Sb}$

C_Y = Side force coefficient = $\frac{\text{Side Force}}{q S}$

MOVABLE SURFACES

C_H = Hinge moment, where subscript (without parenthesis) denotes movable surface = $\frac{\text{Hinge Moment}}{q S_{aft} \bar{c}_{aft}}$

$C_{He}(\delta_e)$ = Elevator hinge moment coefficient versus C_L for various elevator angles

$C_{HS}(\delta_e)$ = Stabilizer hinge moment coefficient versus C_L for various elevator angles

$\delta_{(\ )}$ = Angular deflection in plane normal to axis of rotation, where subscript indicates movable surface

TANK COEFFICIENTS

C_N = Normal force coefficient based on tank planview area = $\frac{\text{Normal Force}}{q S_{plan\ view}}$

C_{Y_F} = Support fairing section side force coefficient = $\frac{\text{Section Side Force}}{q\ c_{fairing}}$

C_Y = Tank Side Force Coefficient = $\frac{\text{Side Force}}{q\ S_{planview}}$

TABLE II

NOMENCLATURE (Cont.)

SUBSCRIPTS

a = Aileron

e = Elevator

s = Stabilizer

r = Rudder

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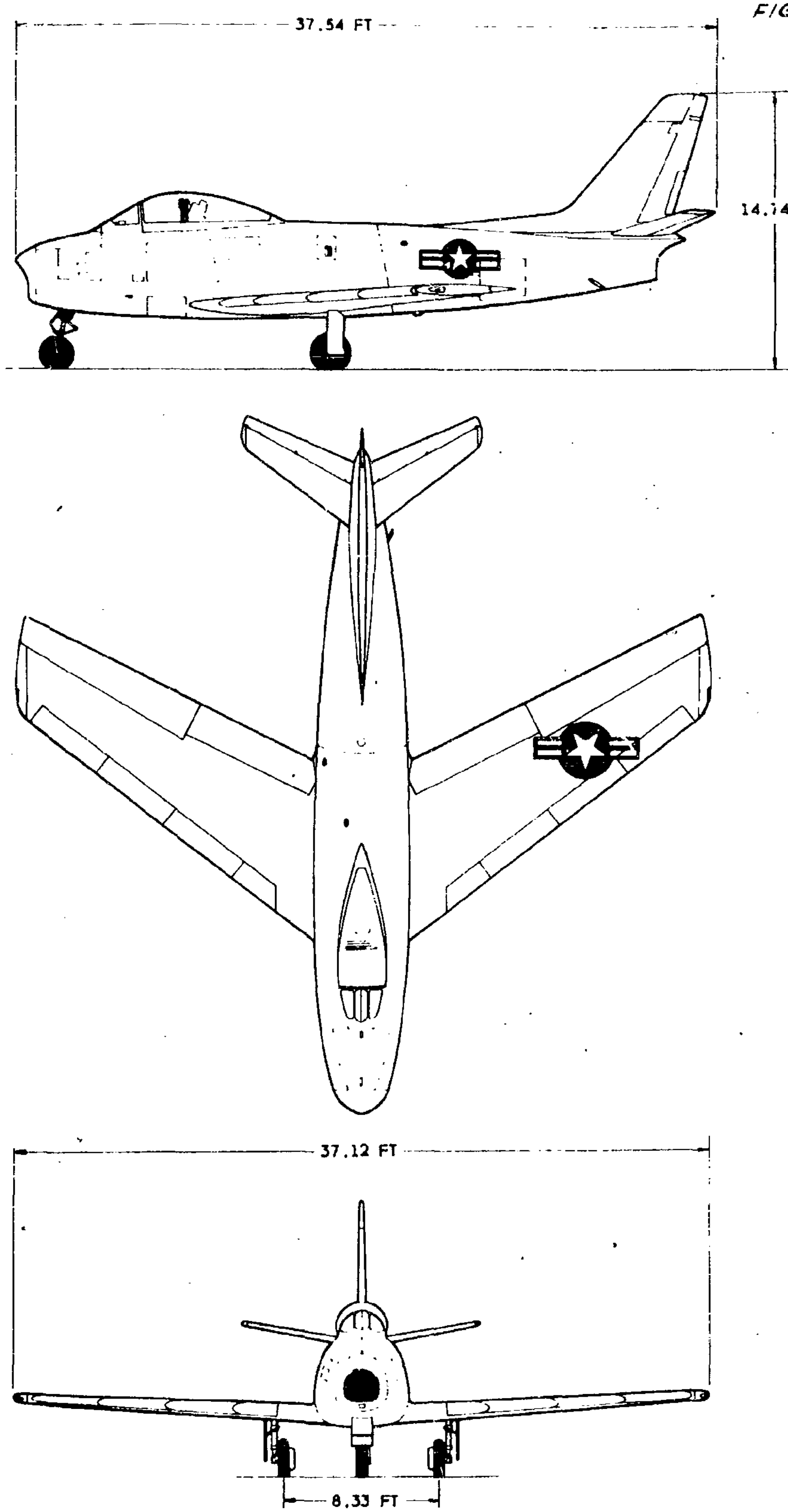
INDEX OF FIGURES (Cont.)

INDEX OF FIGURES (Cont.)

FIG. 1



F-86E
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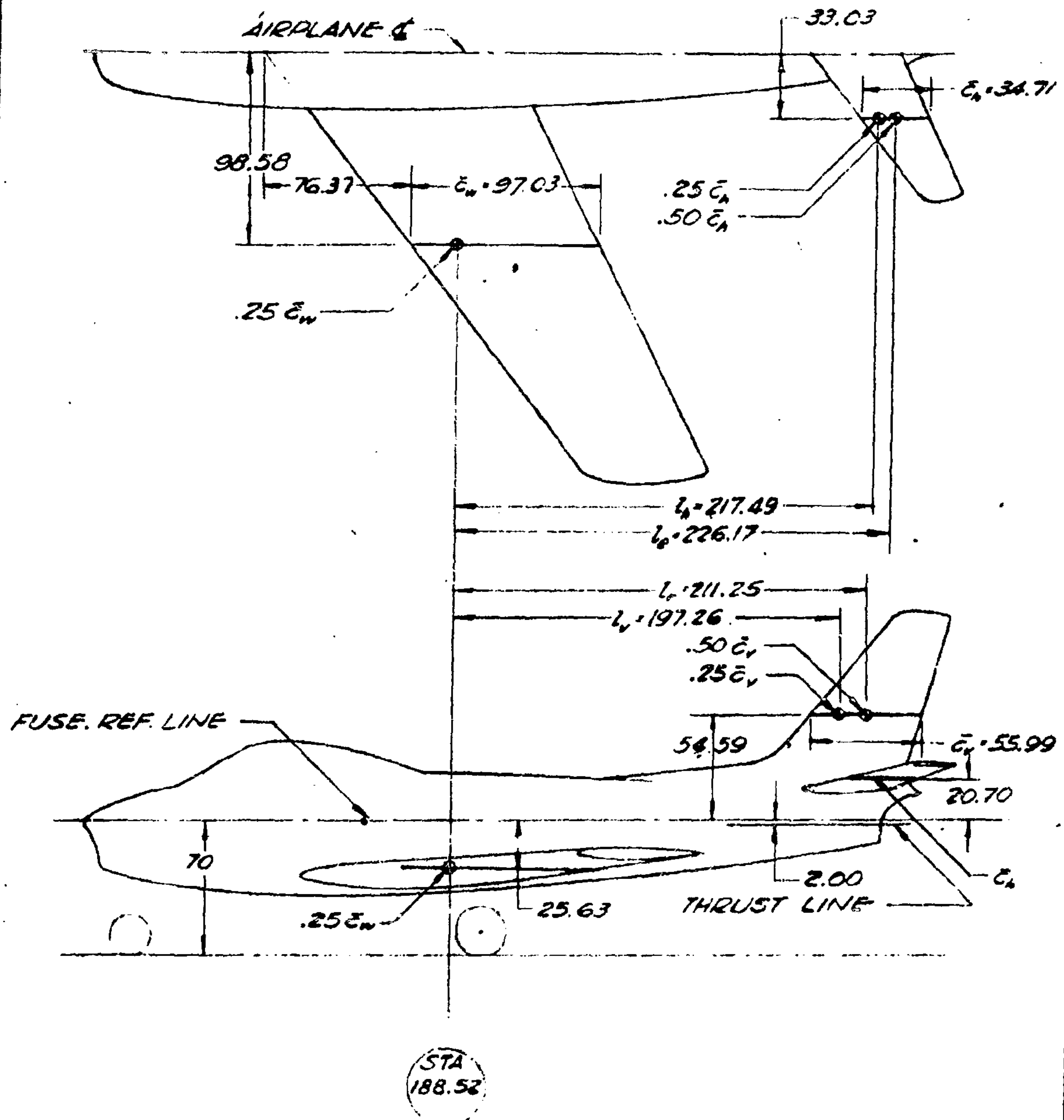
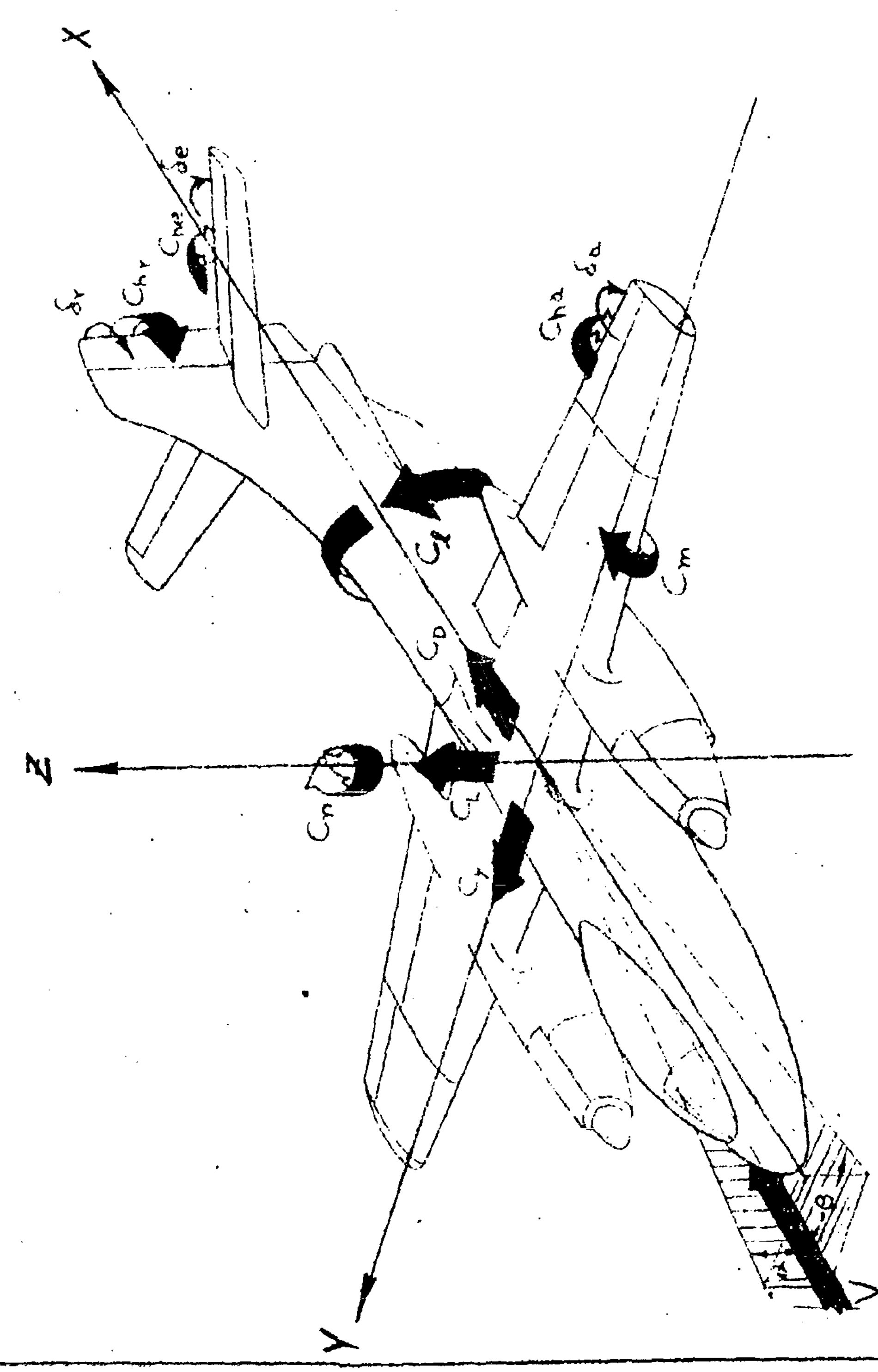
DATE: 8-30-50	M.A.C. DIAGRAM	MODEL NO. F-86E

FIGURE NO. 2



ESTIMATED AERODYNAMIC CHARACTERISTICS

FIG. 3

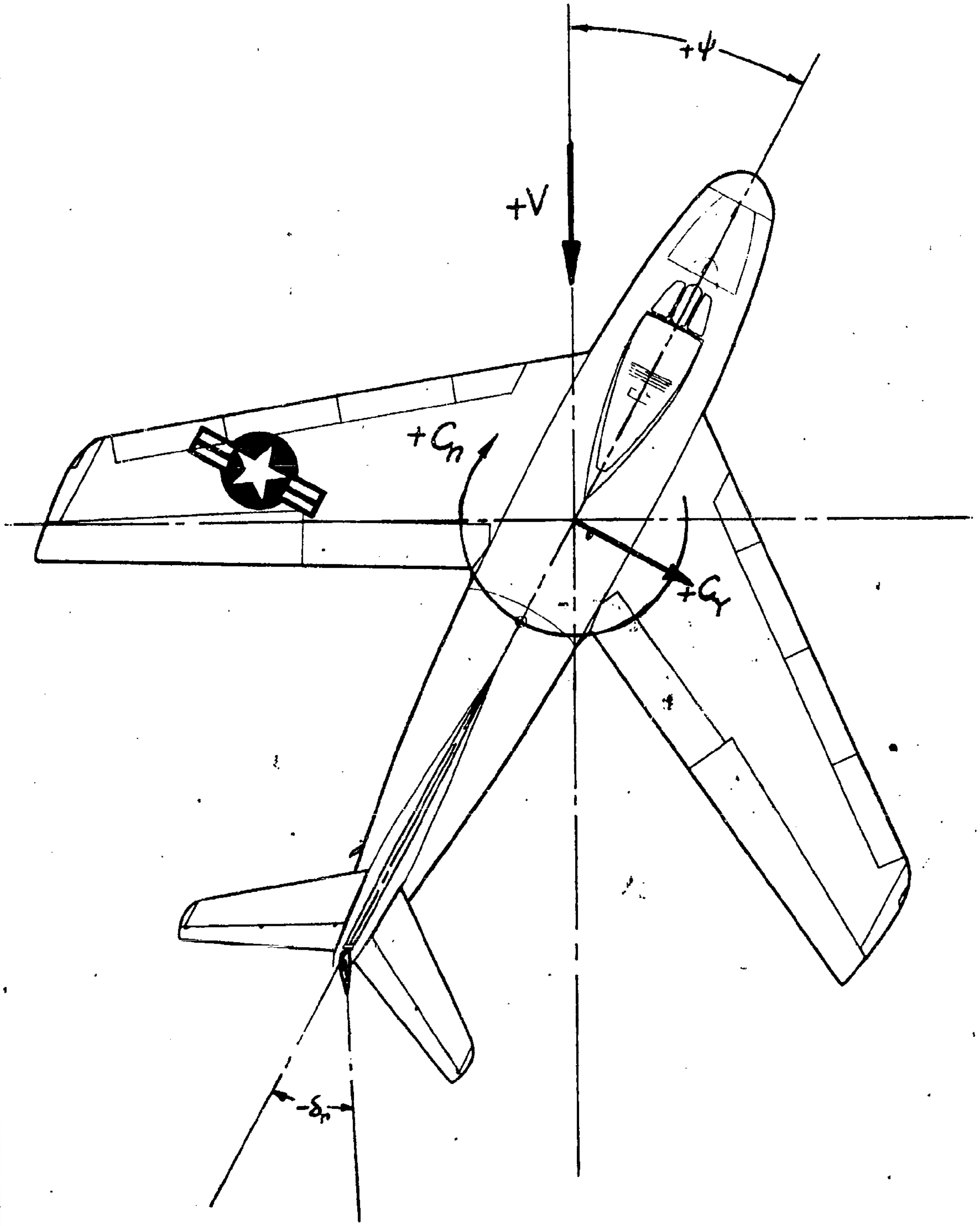


SIGN CONVENTION FOR FLIGHT CONDITIONS

Directions, angles, surface deflections, and coefficients are positive as shown.

FIG. 3a

SIGN CONVENTION
YAW CONDITION



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Cm & α_A VARI[...]

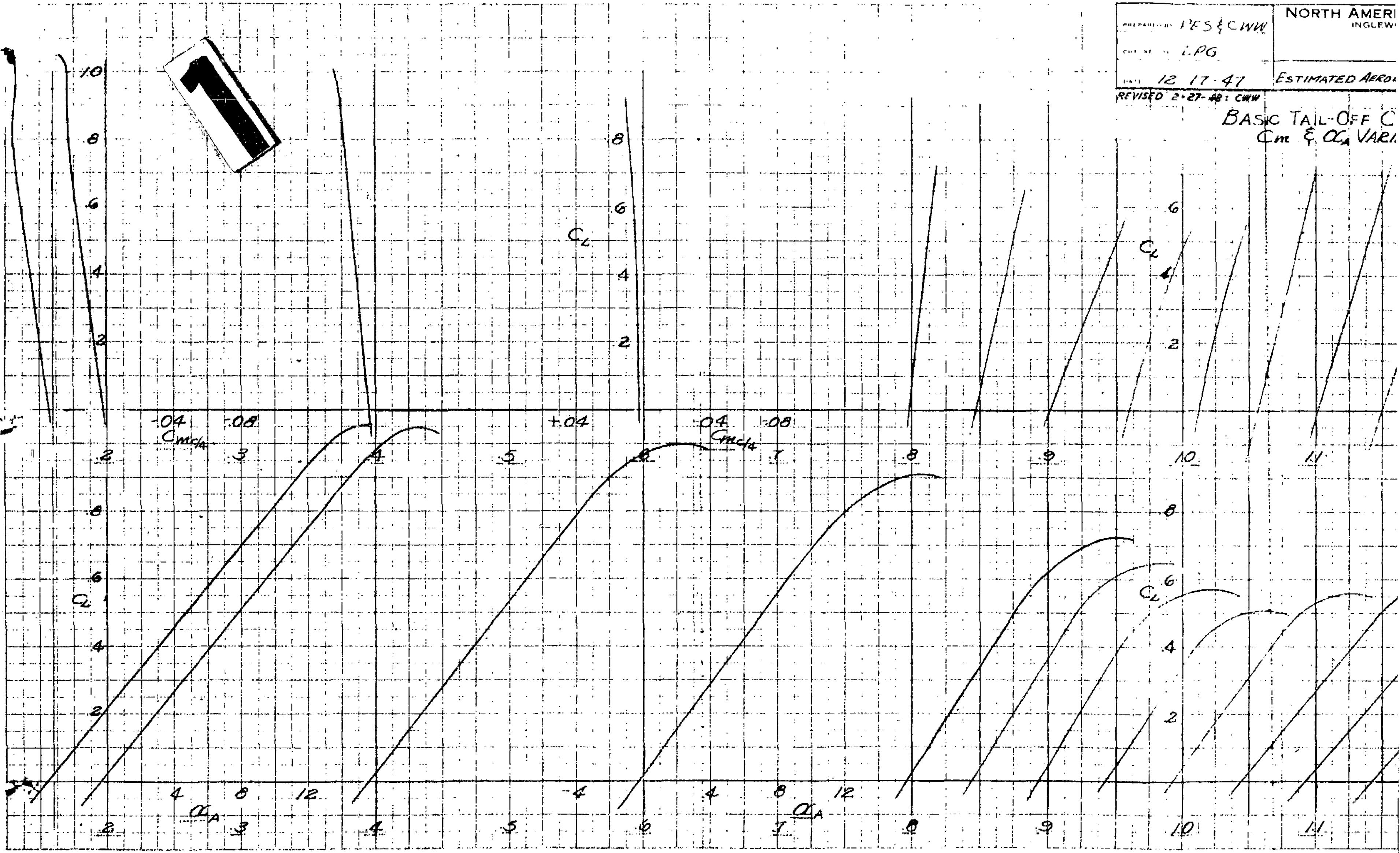

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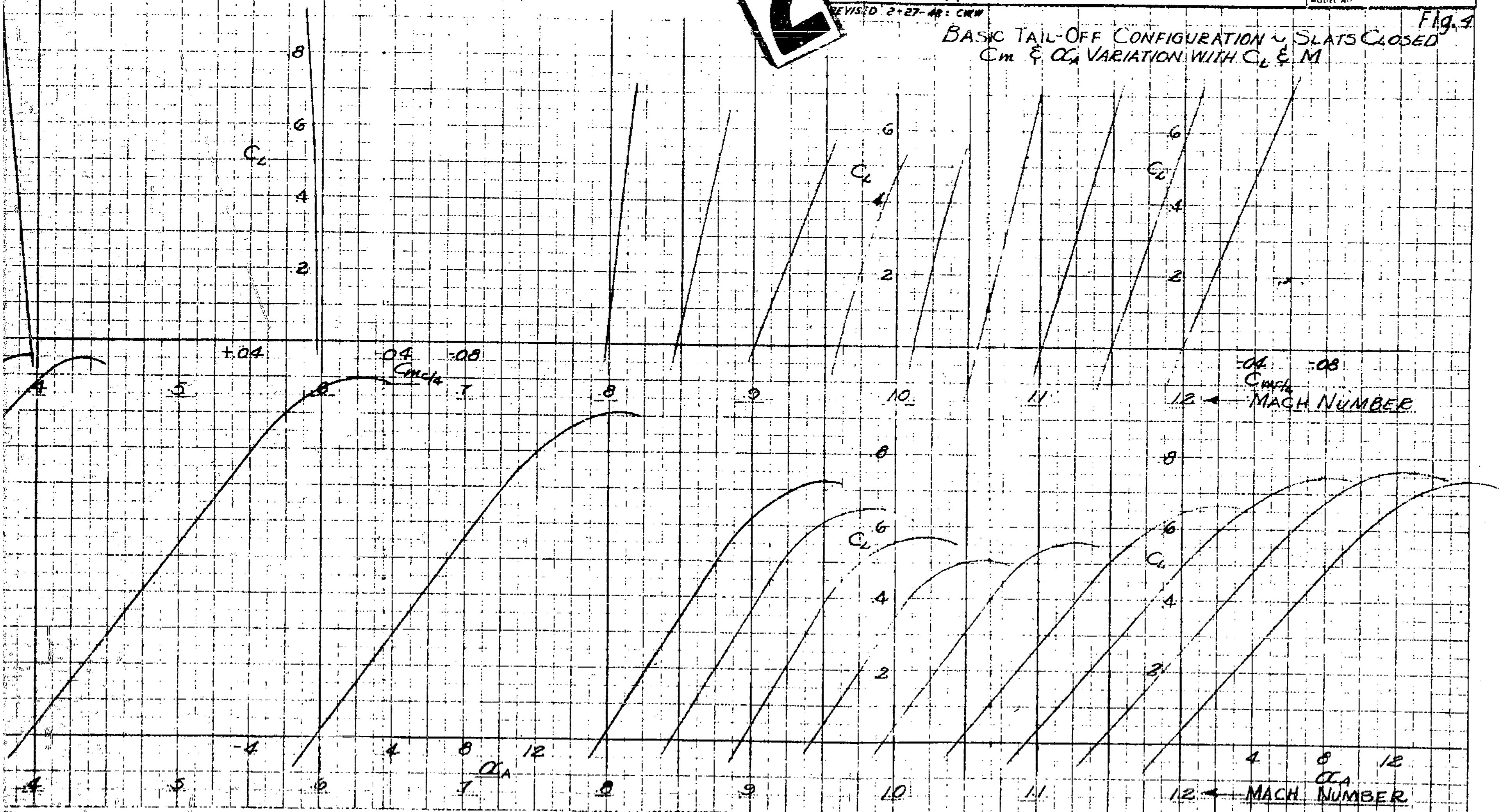
Fig. 4

BASIC TAIL-OFF CONFIGURATION ~ SLATS CLOSED

C_m & α_A VARIATION WITH C_L & M



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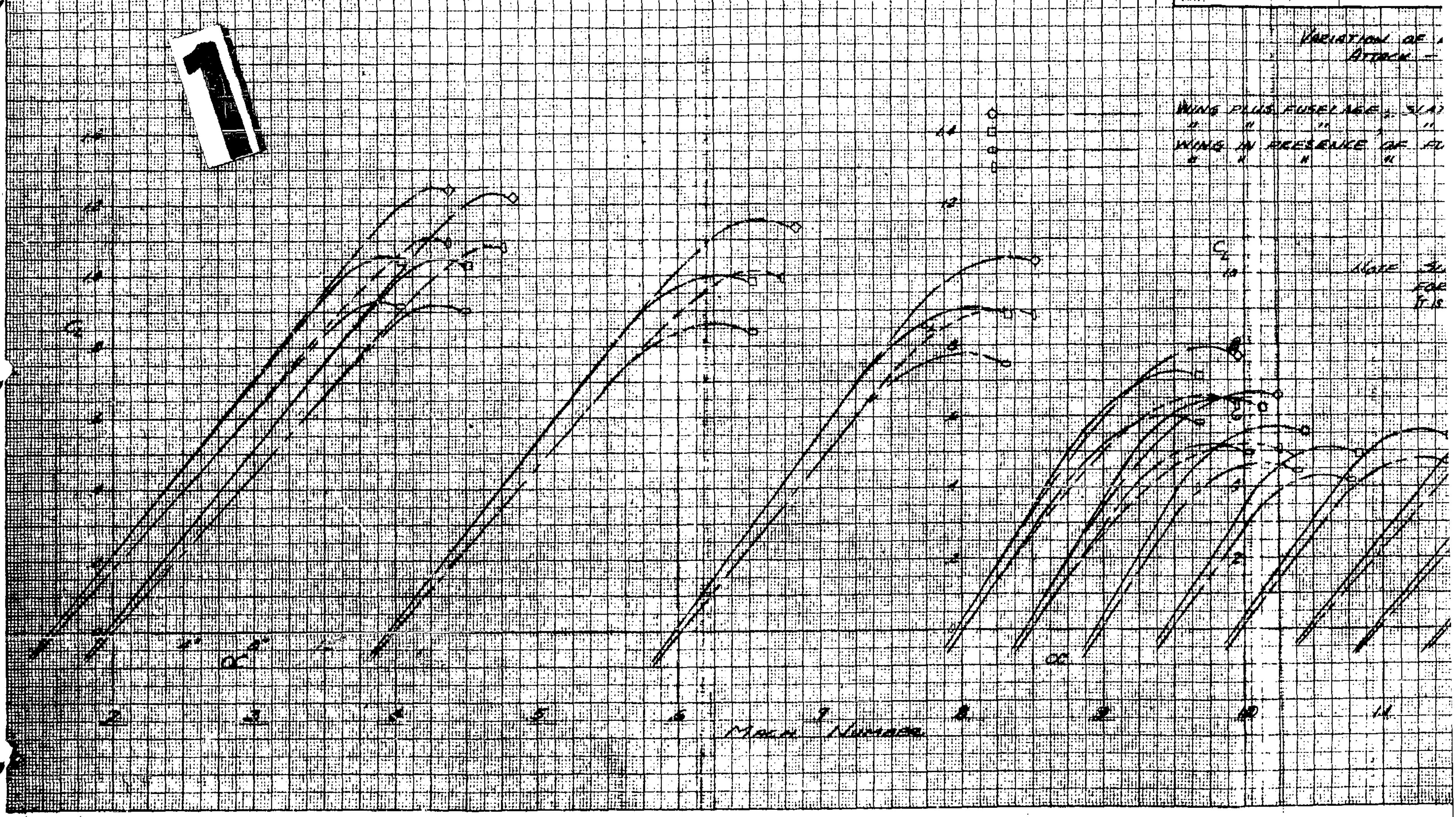

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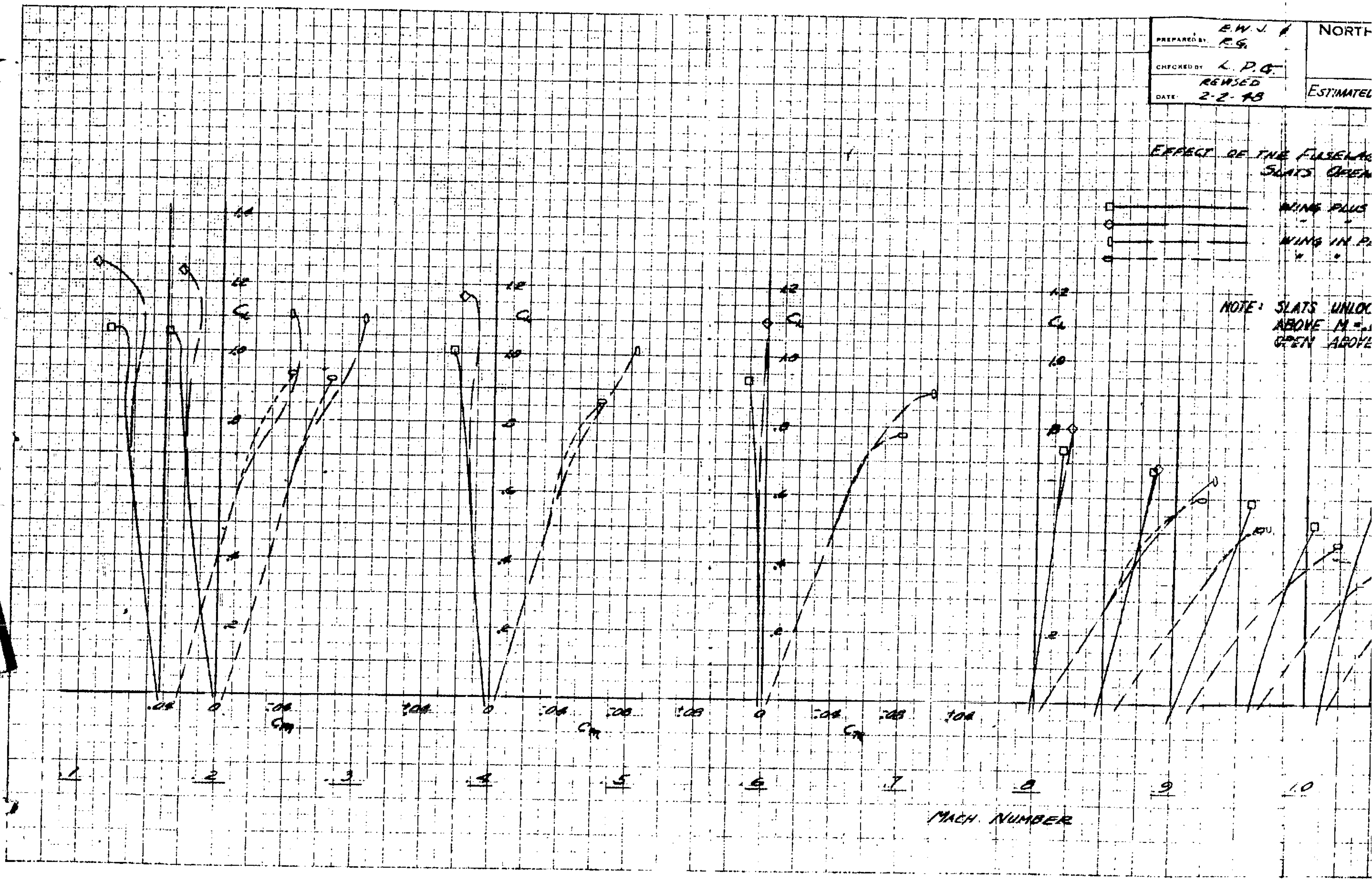
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NORTH
ESTIMATED
EFFECT OF THE FUSELAG
SLATS OPEN
WING PLUS
WING IN P
NOTE: SLATS UNLOC
ABOVE M =
OPEN ABOVE
C_L
C_m
MACH NUMBER

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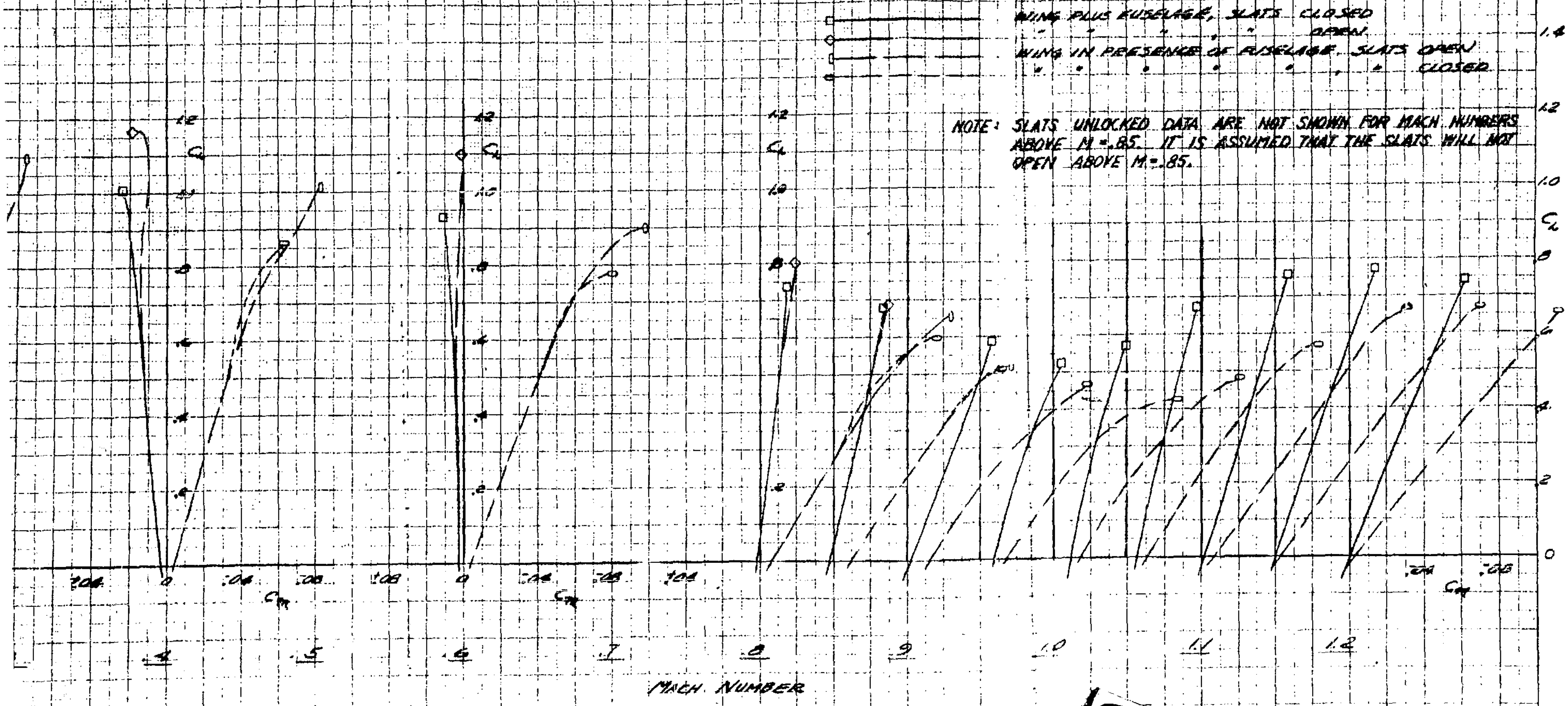
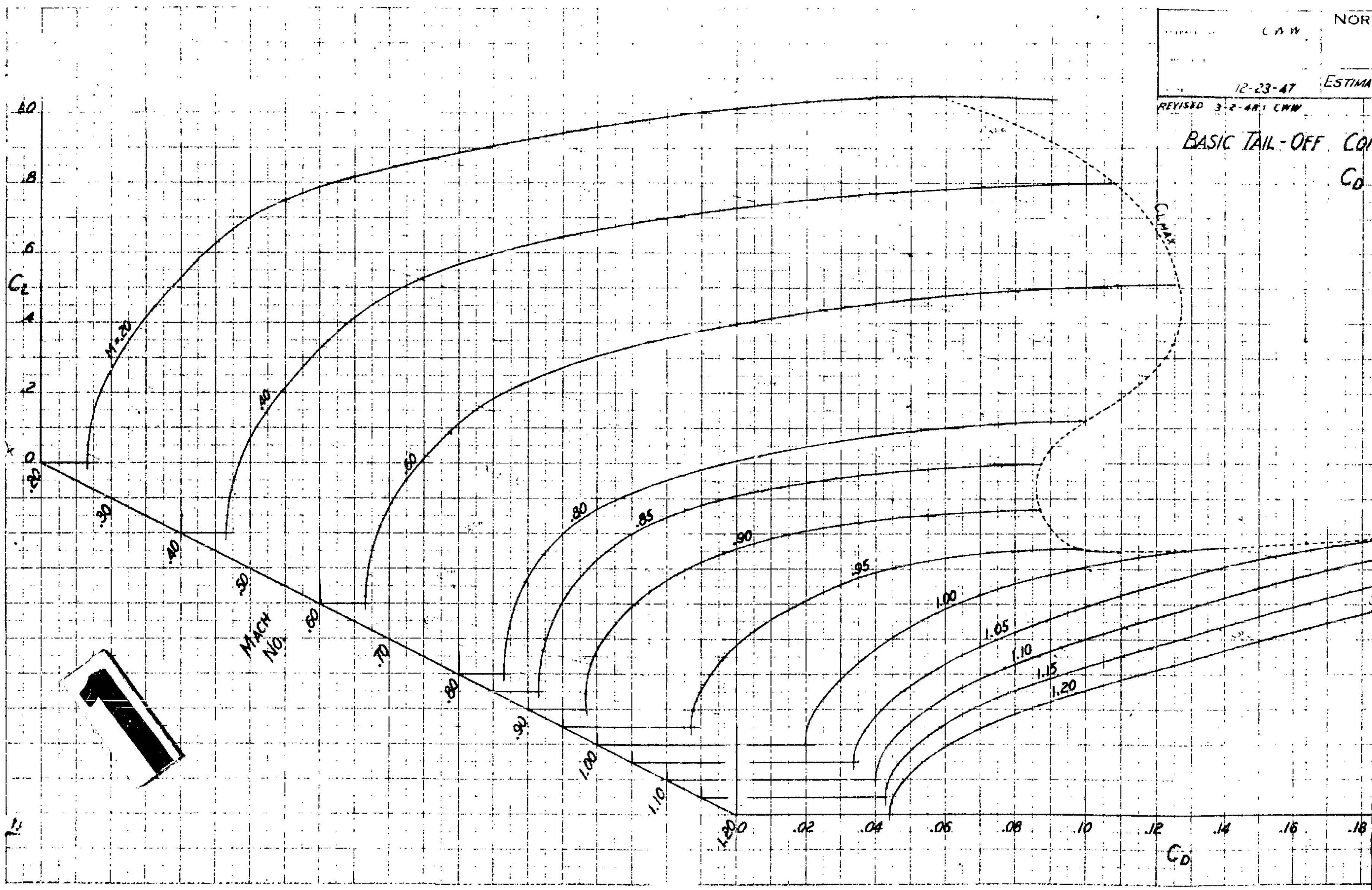
Fig. 6.

EFFECT OF THE FUSELAGE ON THE PITCHING MOMENT DATA
SLATS OPEN AND CLOSED

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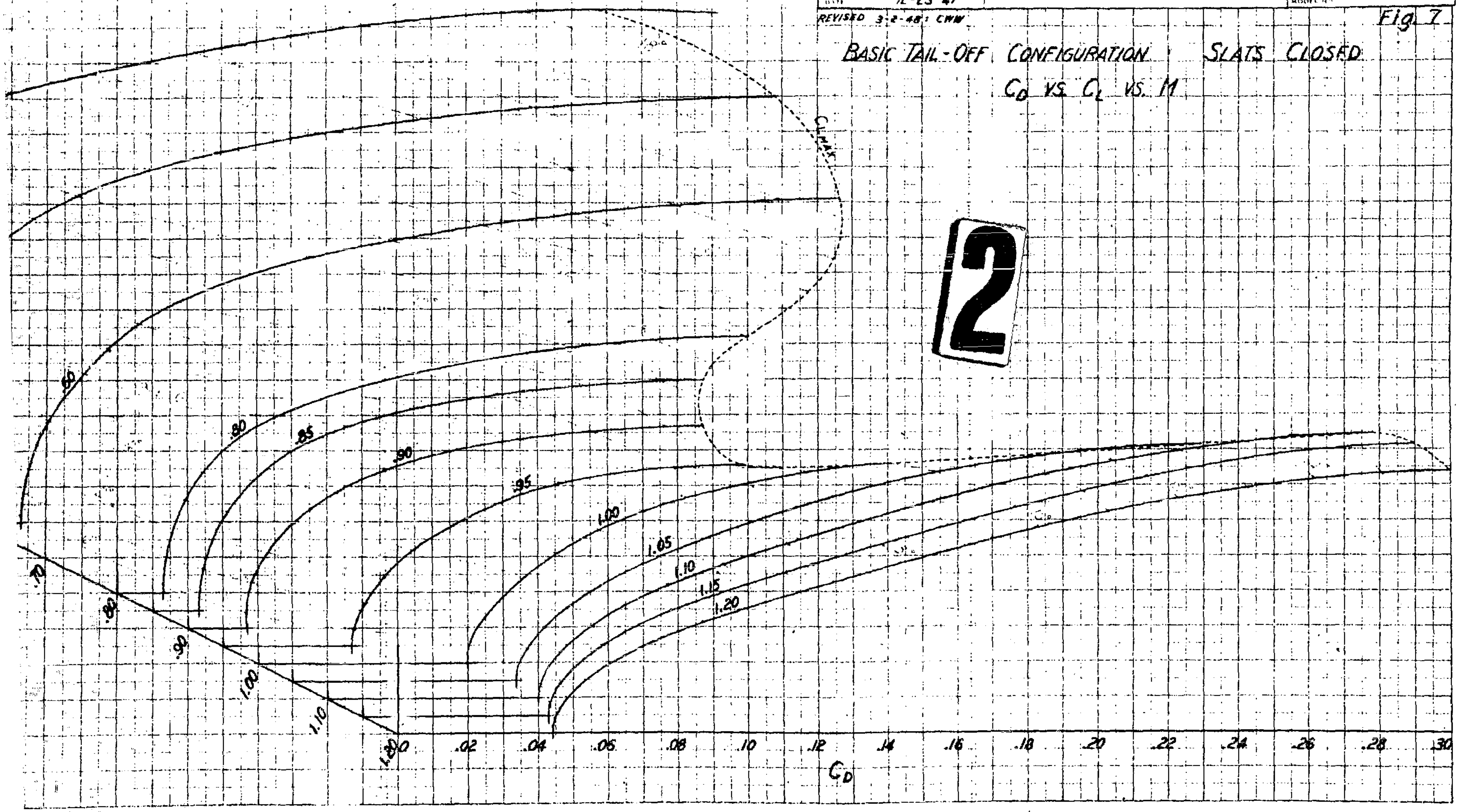
BASIC TAIL-OFF CO
C_D
C_L
$C_{L MAX}$
M=.20
.40
.60
.80
.85
.90
.95
1.00
1.05
1.10
1.15
1.20
MACH NO.
.20
.30
.40
.50
.60
.70
.80
.90
1.00
1.10
1.20
0
.2
.4
.6
.8
1.0
.02
.04
.06
.08
.10
.12
.14
.16
.18

Fig. 7

BASIC TAIL-OFF CONFIGURATION SLATS CLOSED

C_D VS. C_L VS. M



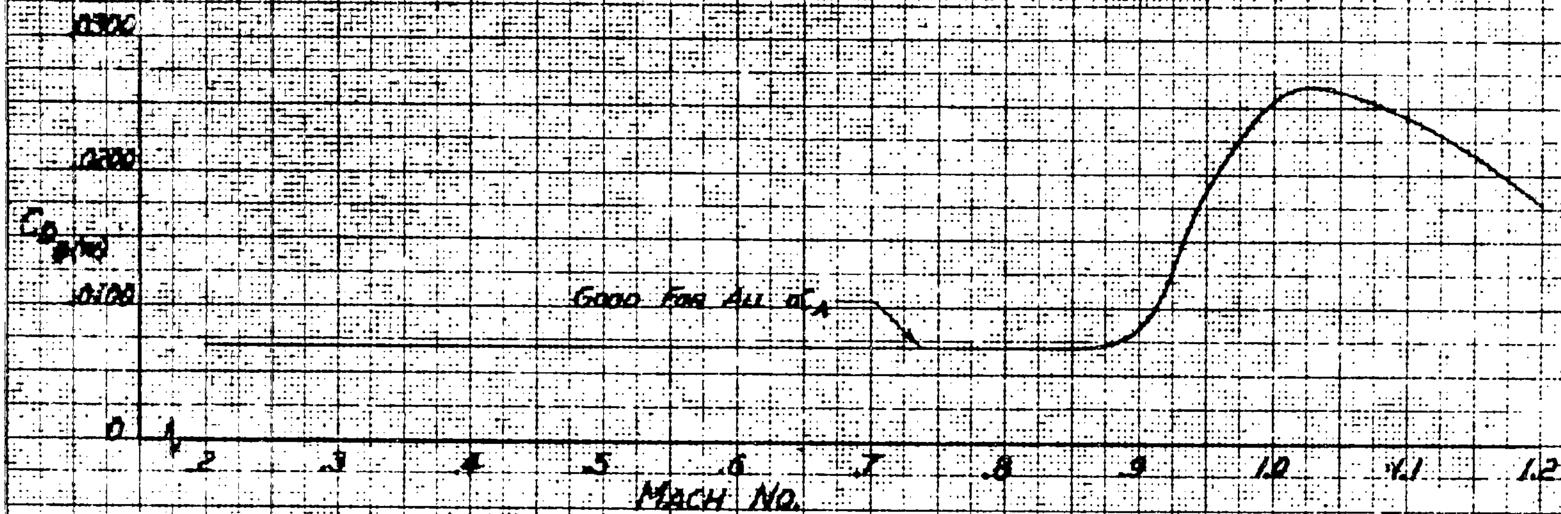
FORM ED-148

PREPARED BY CWW	NORTH AMERICAN AVIATION, INC.	PAGE NO. 30 OF 82	
CHECKED BY		REPORT NO. NA-50-1277	
DATE 3-2-48	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO. F-86E	

Fig. 8

DRAG COEF. OF FUSELAGE IN PRESENCE OF WING, $C_{D_{B(W)}}$, VS. MACH NUMBER

TAIL-OFF, SLATS RETRACTED, $\delta_F = 0°$

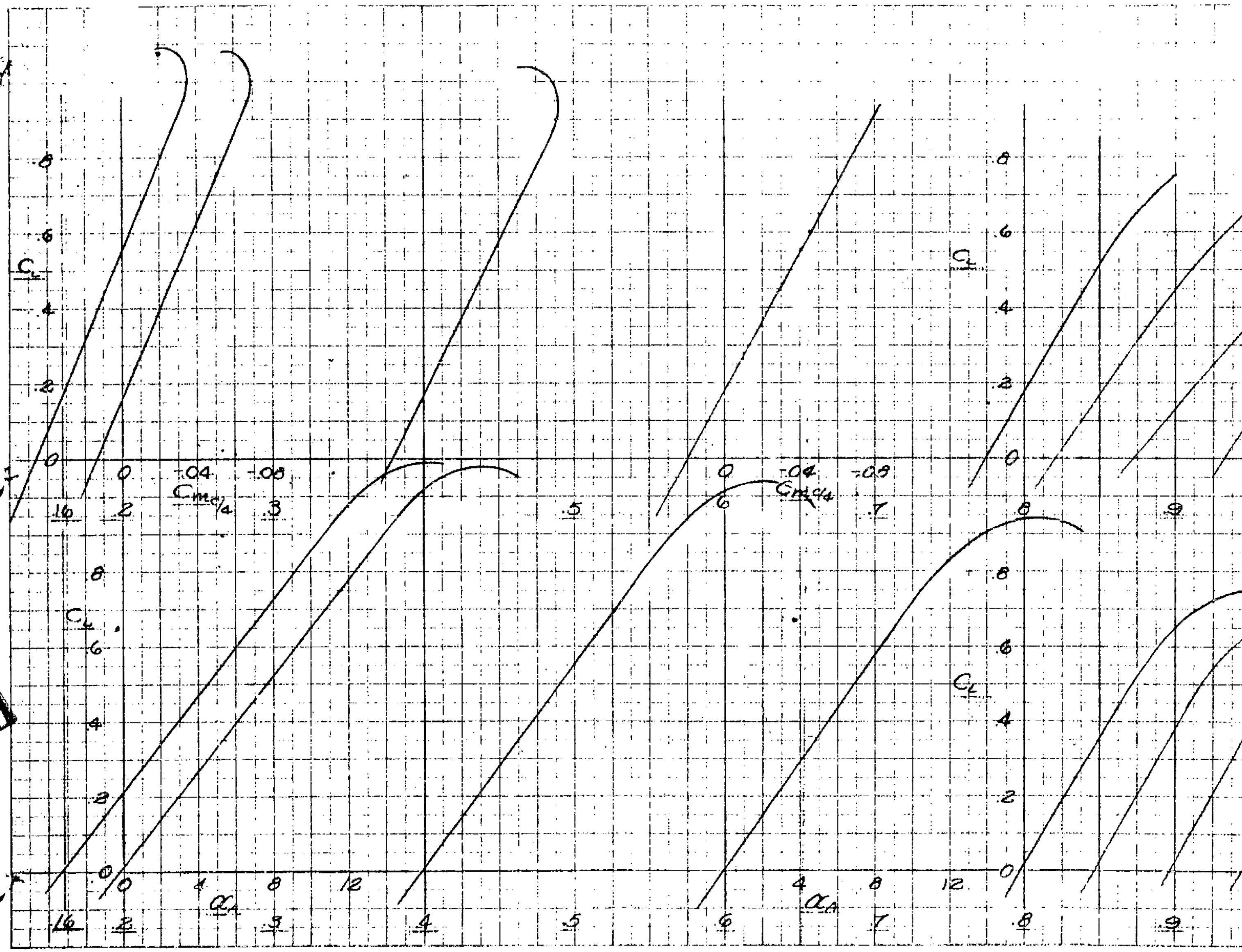


NOTE: THIS CURVE IS PRESENTED FOR USE IN DETERMINING THE DRAG CHARACTERISTICS OF THE WING IN PRESENCE OF FUSELAGE, $C_{D_{W(B)}}$. HAVING COMPLETE DRAG CHARACTERISTICS OF THE BASIC TAIL OFF CONFIGURATION, $C_{D_{WB}}$, IT IS POSSIBLE TO FIND $C_{D_{W(B)}}$ FOR ANY CONDITION AS FOLLOWS:

$$C_{D_{W(B)}} = C_{D_{WB}} - C_{D_{B(W)}}$$

GALBANIZED NO. 1001 ...

PREPARED BY P.E.S.
LPG
DATE 12-16-41
REVISED 2-26-43: CHW
NORTH
ESTIMATED
BASIC TAIL-
C_m & α_A
δ_S =



Prepared by P.E.S.	NORTH AMERICAN AVIATION, INC. INGLEWOOD, CALIFORNIA		Page No. 31 of 82
Checked by L.P.G.			Report No. NA-50-1277
Date 12-16-41	ESTIMATED AERODYNAMIC CHARACTERISTICS		Model No. F-86E

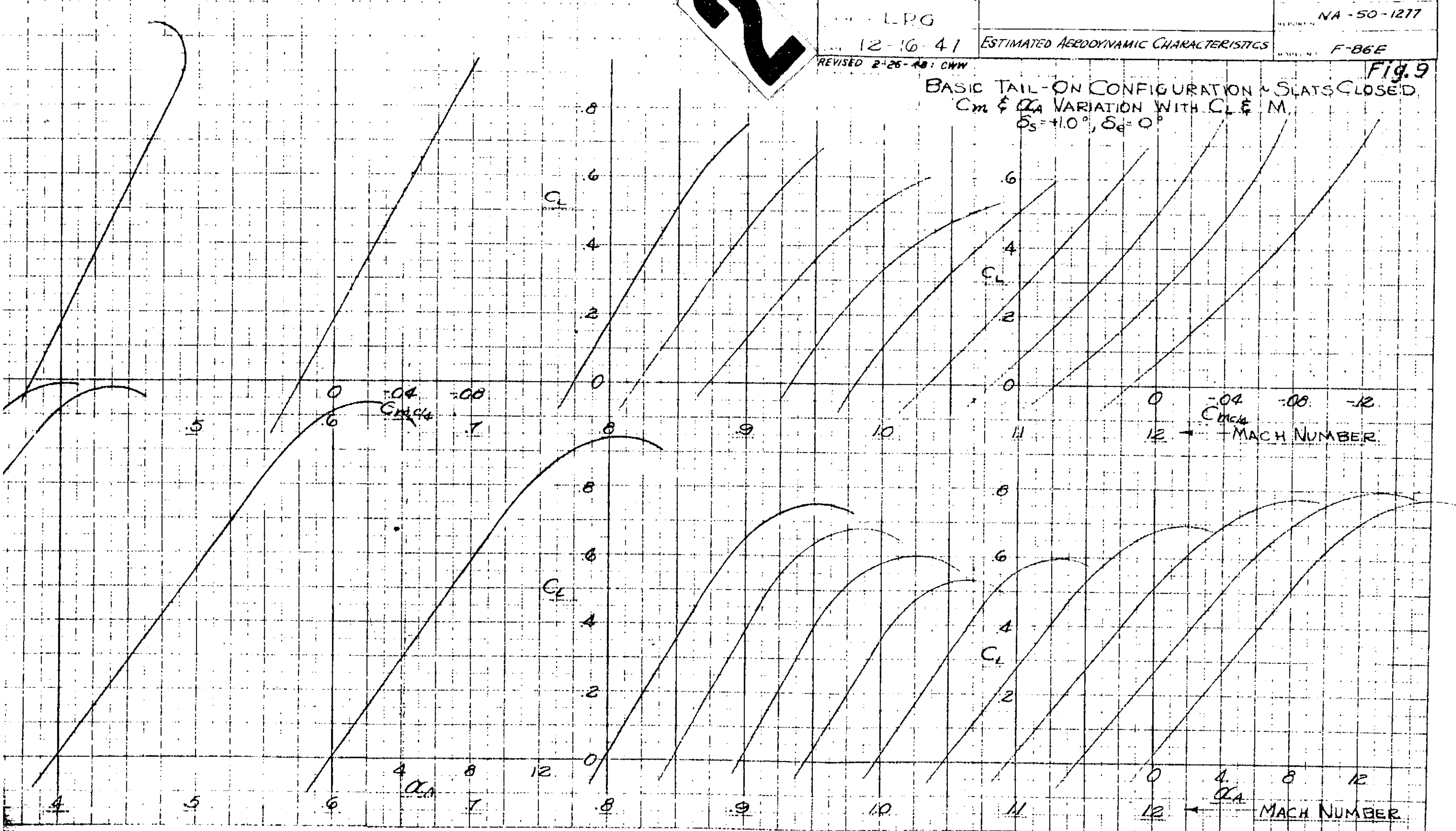
REVISED 2-26-48: CWW

Fig. 9

BASIC TAIL-ON CONFIGURATION ~ SLATS CLOSED

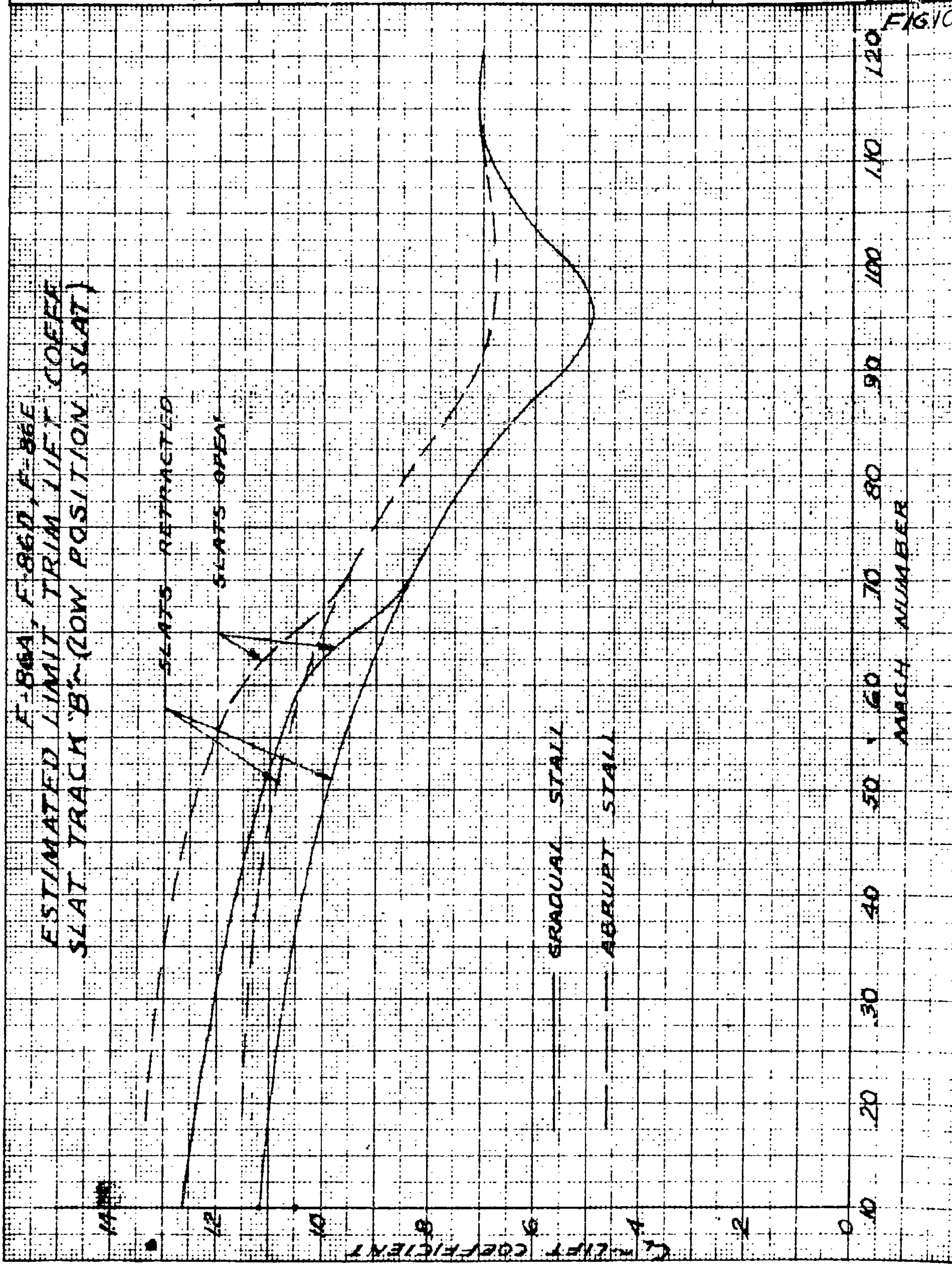
C_m & α_A VARIATION WITH C_L & M.

$\delta_s = +1.0°$, $\delta_e = 0°$



PREPARED BY: DJB	NORTH AMERICAN AVIATION, INC.	PAGE NO 32 OF 82
CHECKED BY: W.E.S.		REPORT NO NA-50-1277
DATE: 10-24-49	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO F-86A, F-86D, F-86E

FIG 10



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NORTH AMERICAN AVIATION, INC.

PREPARED BY: HTO		PAGE NO 33 OF 82
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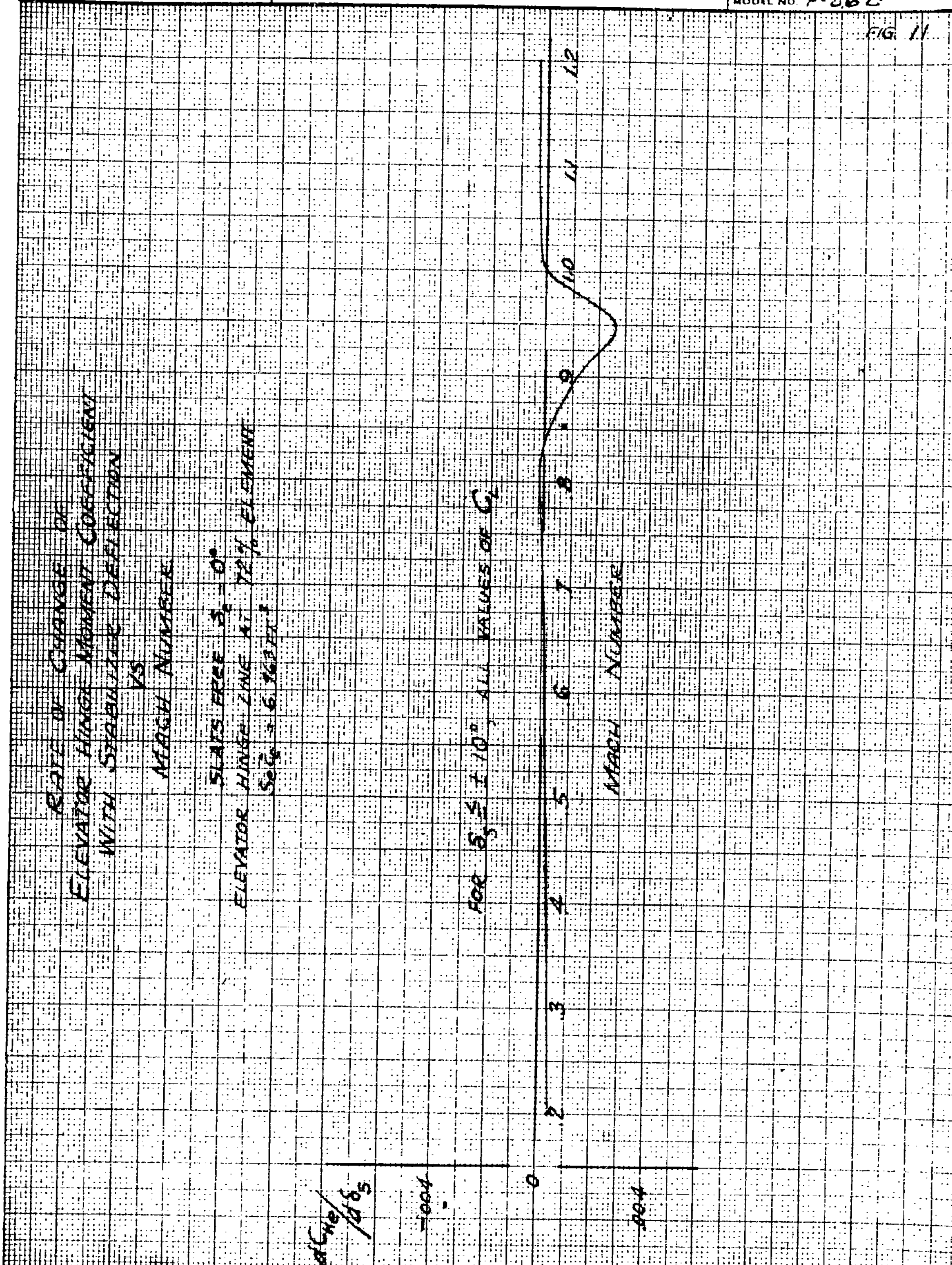
DATE: 1-24-50	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO. F-86E

FIG. 11



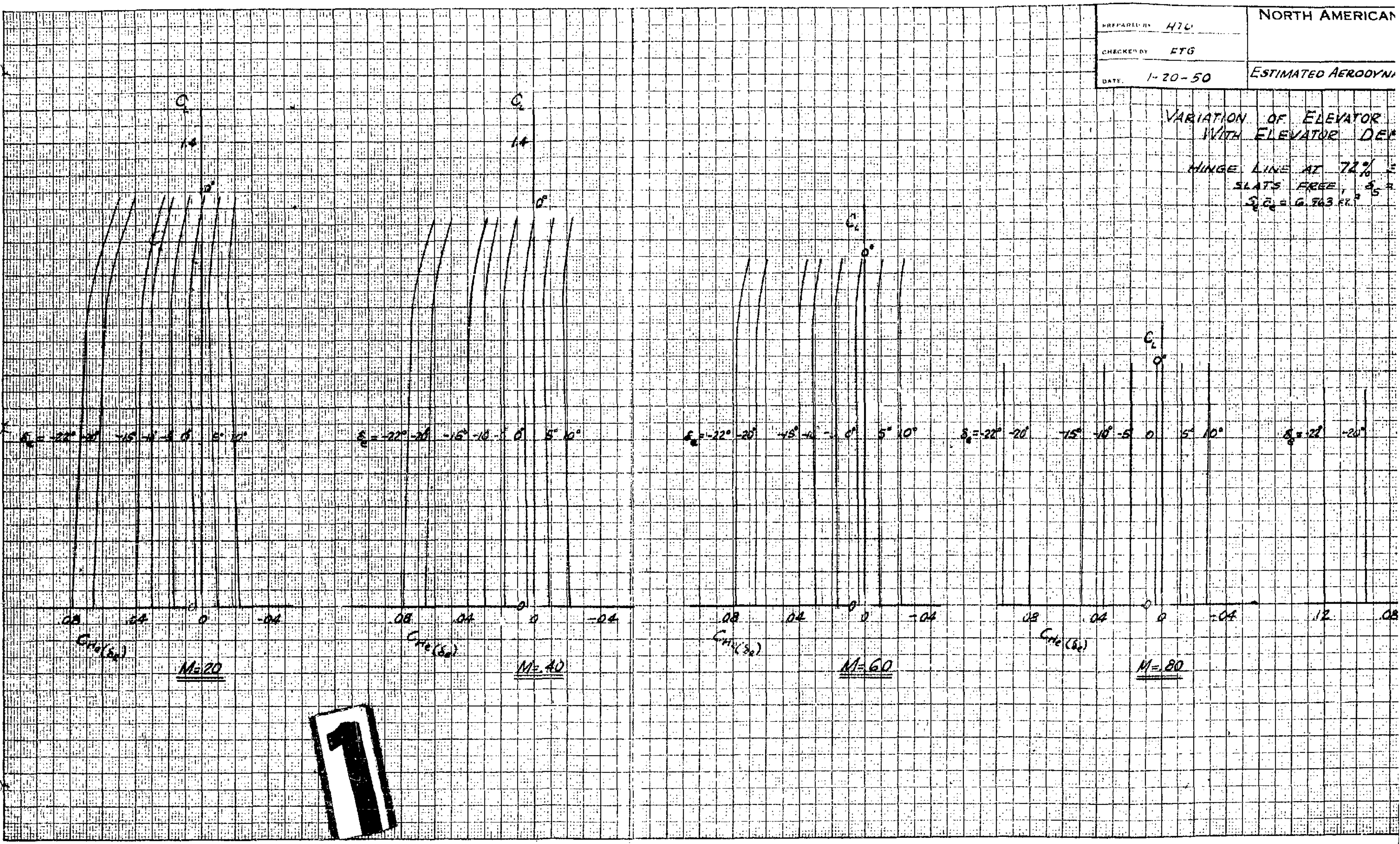
PREPARED BY: HTC
CHECKED BY: FTG
DATE: 1-20-50

NORTH AMERICAN

ESTIMATED AERODYN

VARIATION OF ELEVATOR
WITH ELEVATOR DE

HINGE LINE AT 72%
SLATS FREE, δ_s =
$S_e \bar{c}_e$ = 6.563 FT.^{3}



HTC	NORTH AMERICAN AVIATION, INC.	PAGE NO. 34 OF 82
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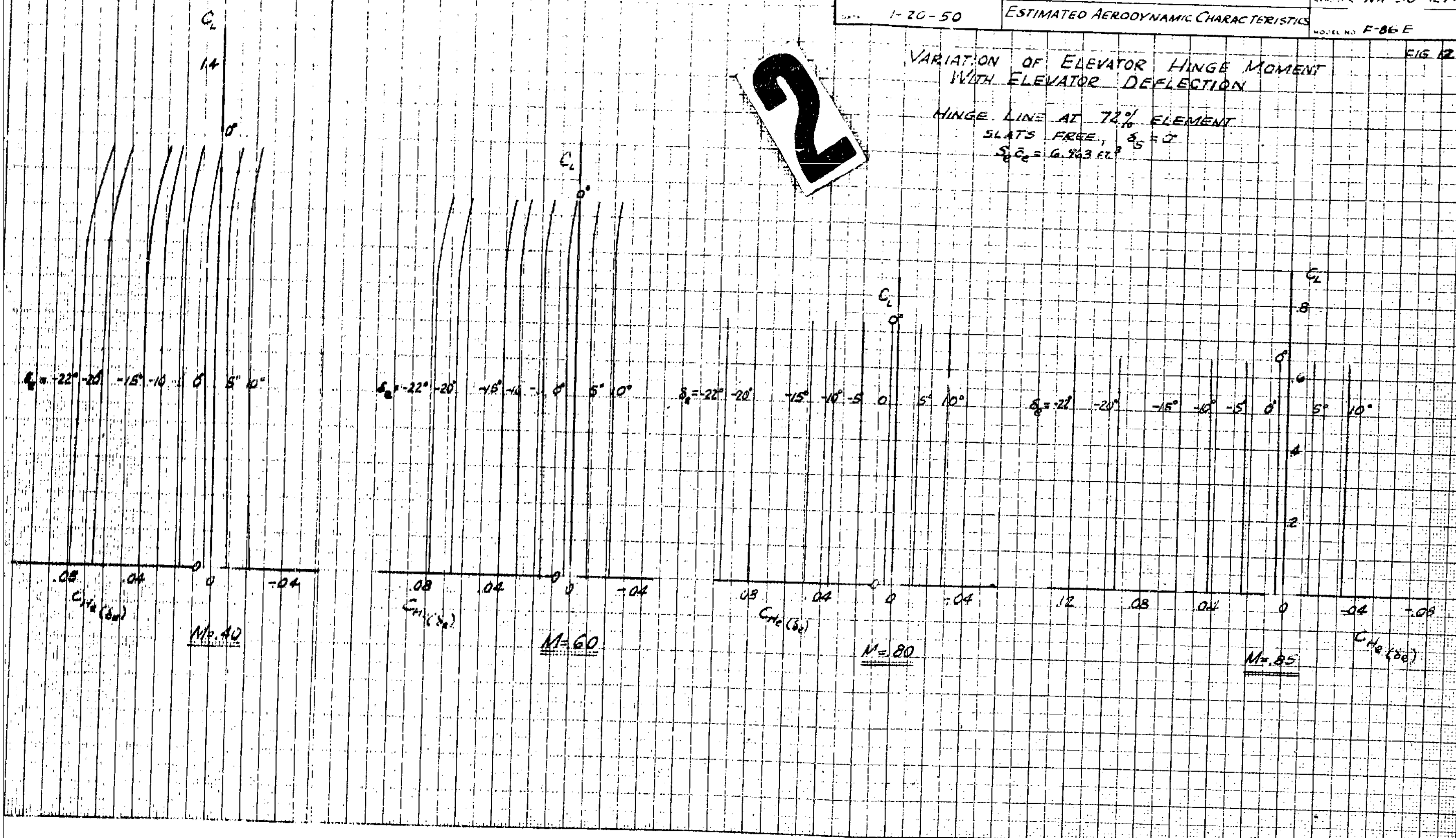
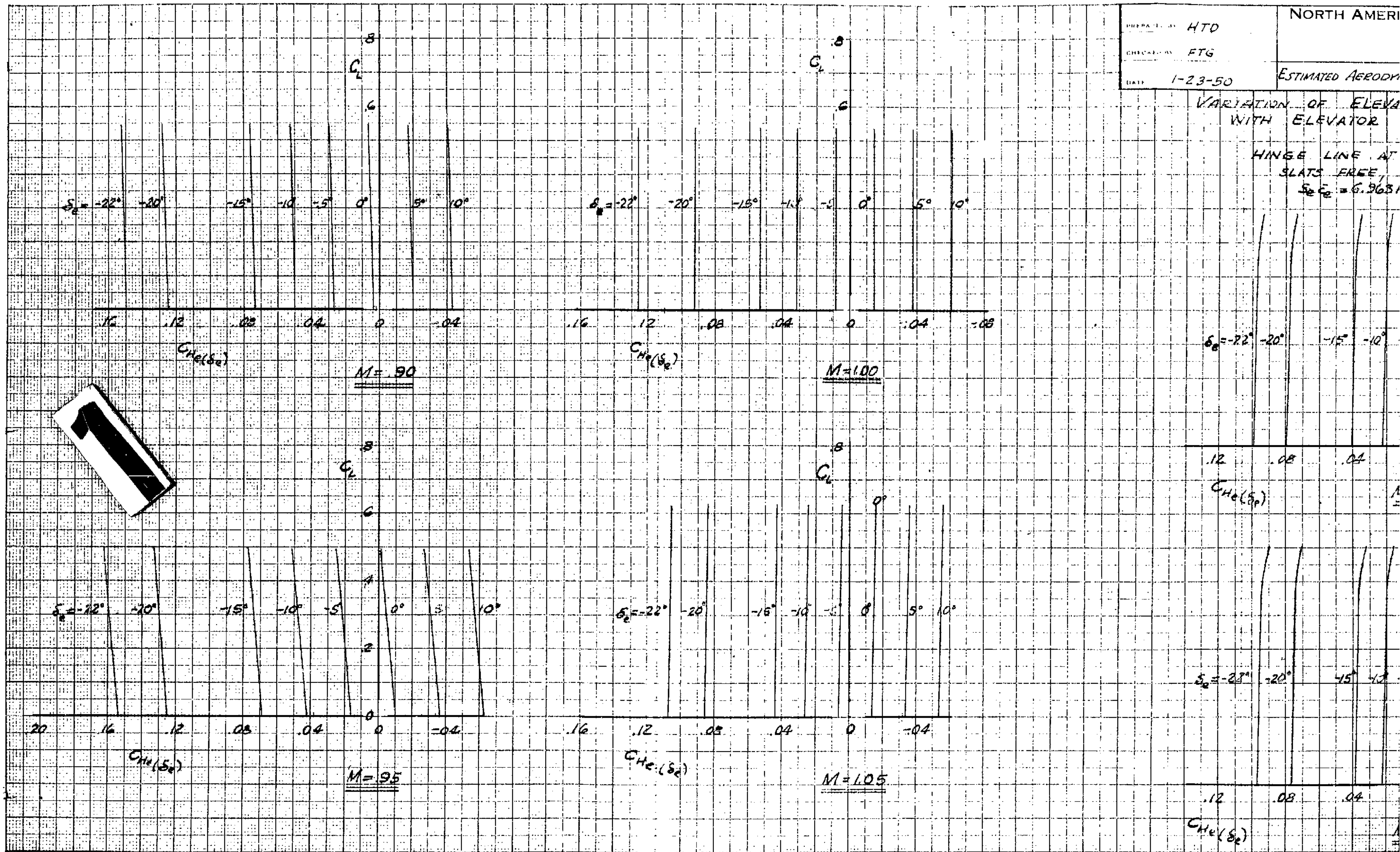
FIG 12

2

VARIATION OF ELEVATOR HINGE MOMENT WITH ELEVATOR DEFLECTION

HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_S = 0°$
$S_e \bar{c}_e = 6.963\ ft.^3$





PREPARED BY HTD
CHECKED BY FTG
DATE 1-23-50
NORTH AMERI
ESTIMATED AERODY
VARIATION OF ELEVA
WITH ELEVATOR
HINGE LINE AT
SLATS FREE,
$S_e \bar{c}_e = 6.963$
C_L
$\delta_e = -22°$ -20° -15° -10° -5° 0° 5° 10°
$C_{H_e(\delta_e)}$
M = .90
M = 1.00
M = .95
M = 1.05

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FIG. 13

VARIATION OF ELEVATOR HINGE MOMENT WITH ELEVATOR DEFLECTION

HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_S = 0°$
$S_e \bar{c}_e = 6.963 \, FT^3$

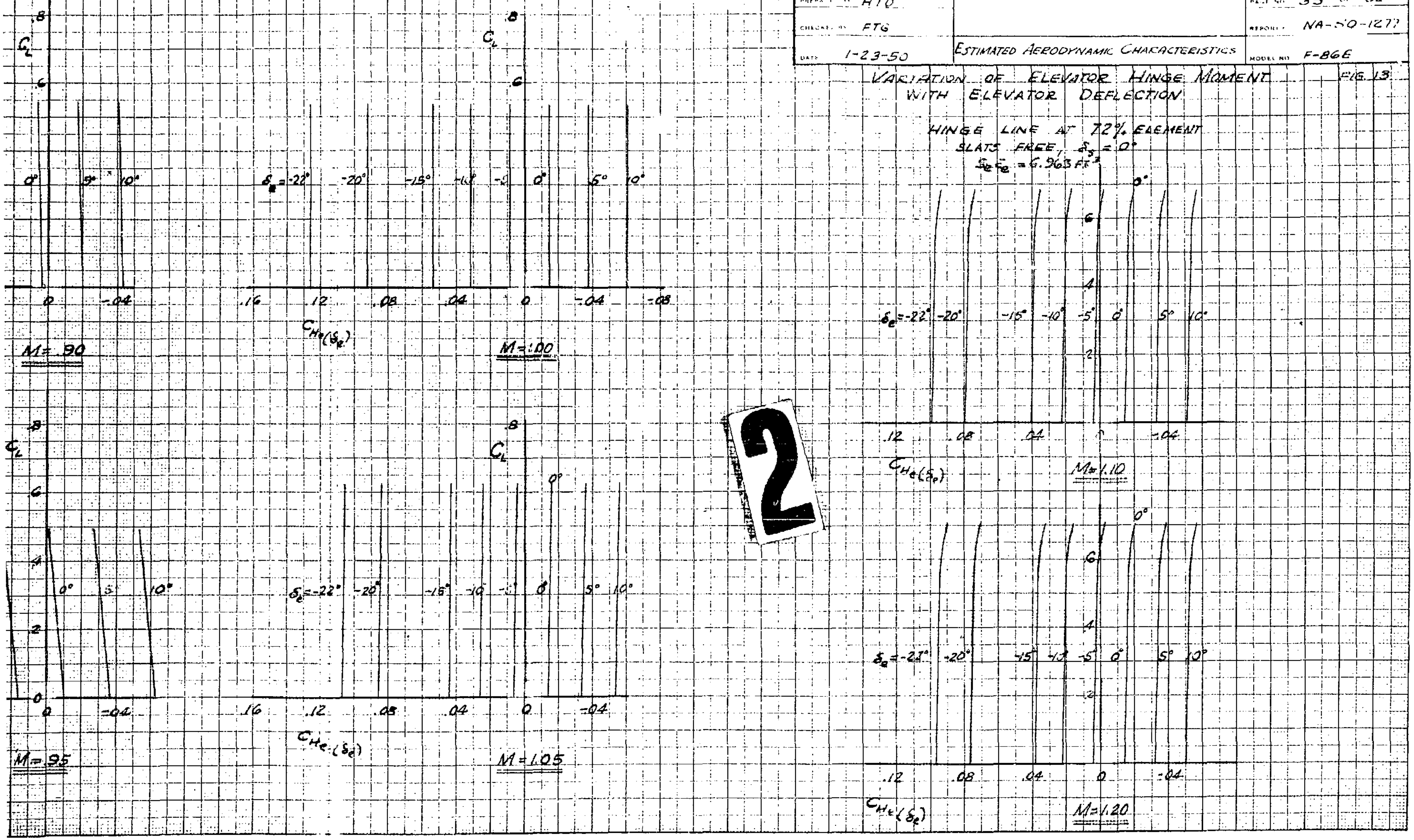

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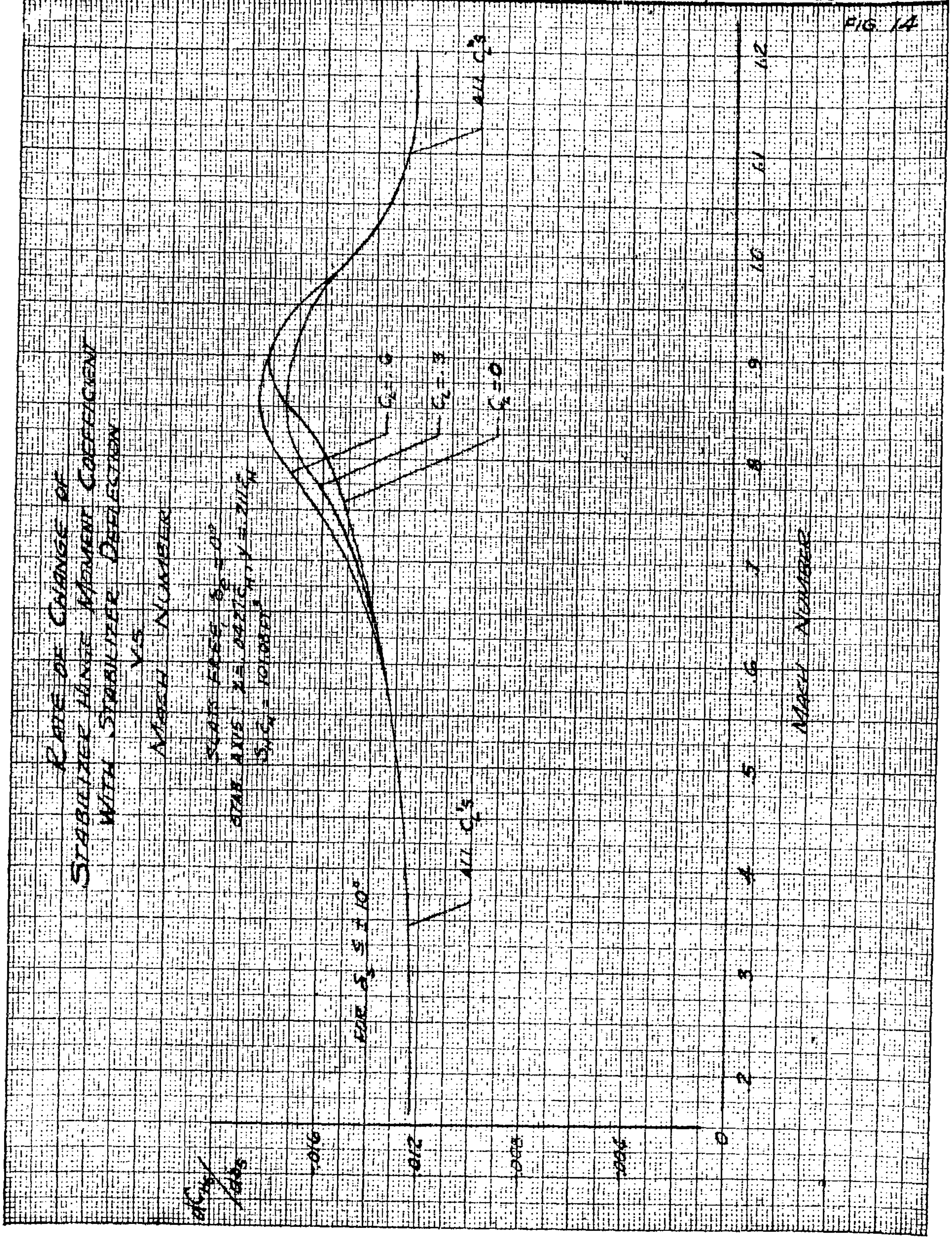
FIG. 14



PREPARED BY: HTD | CHECKED BY: FTG | DATE: 1-18-50

NORTH AMERI

ESTIMATED AERODY

VARIATION OF STABILIZ
WITH ELEVATOR

ELEVATOR HINGE LINE
SLATS FREE, $\delta_s = 0$
$S_H \bar{c}_H = 101.08 \ FT^3$

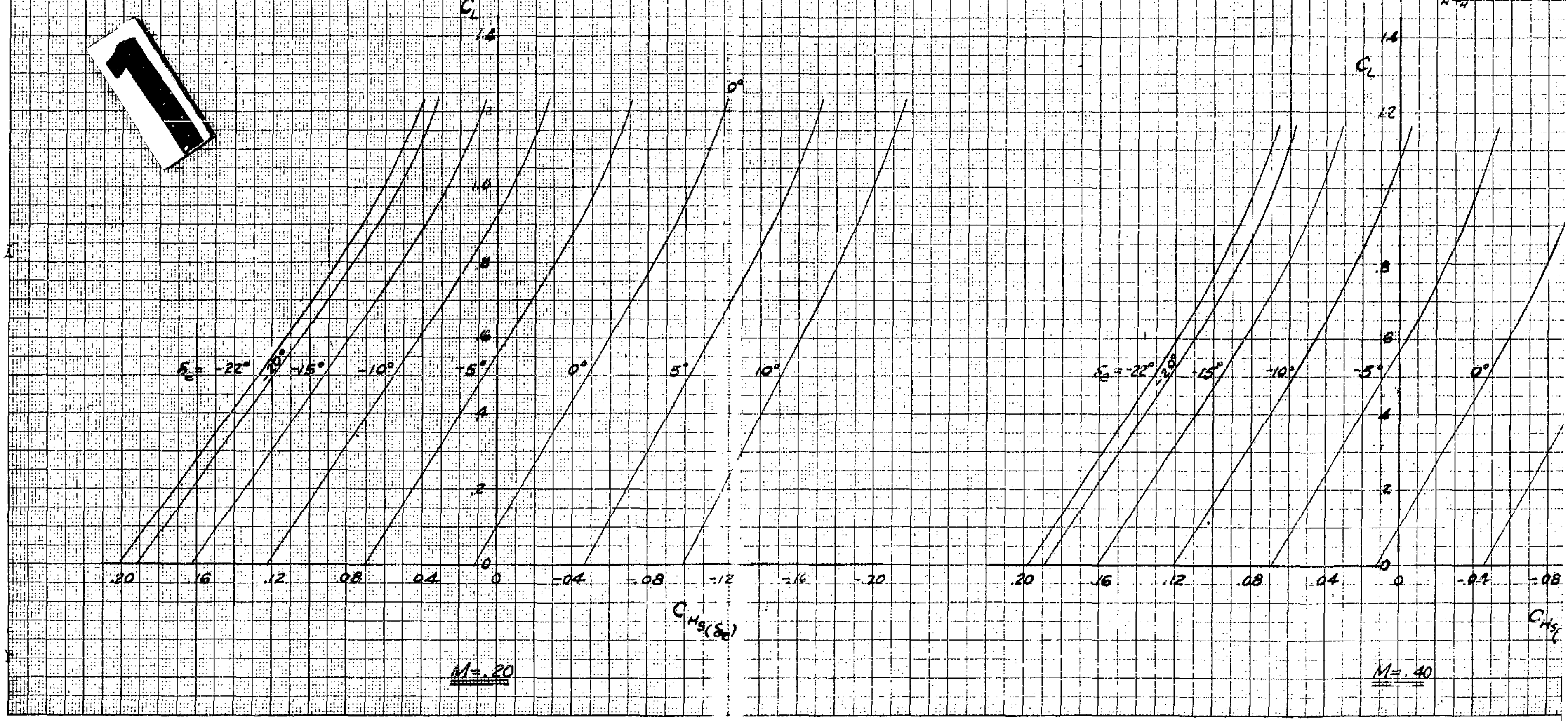


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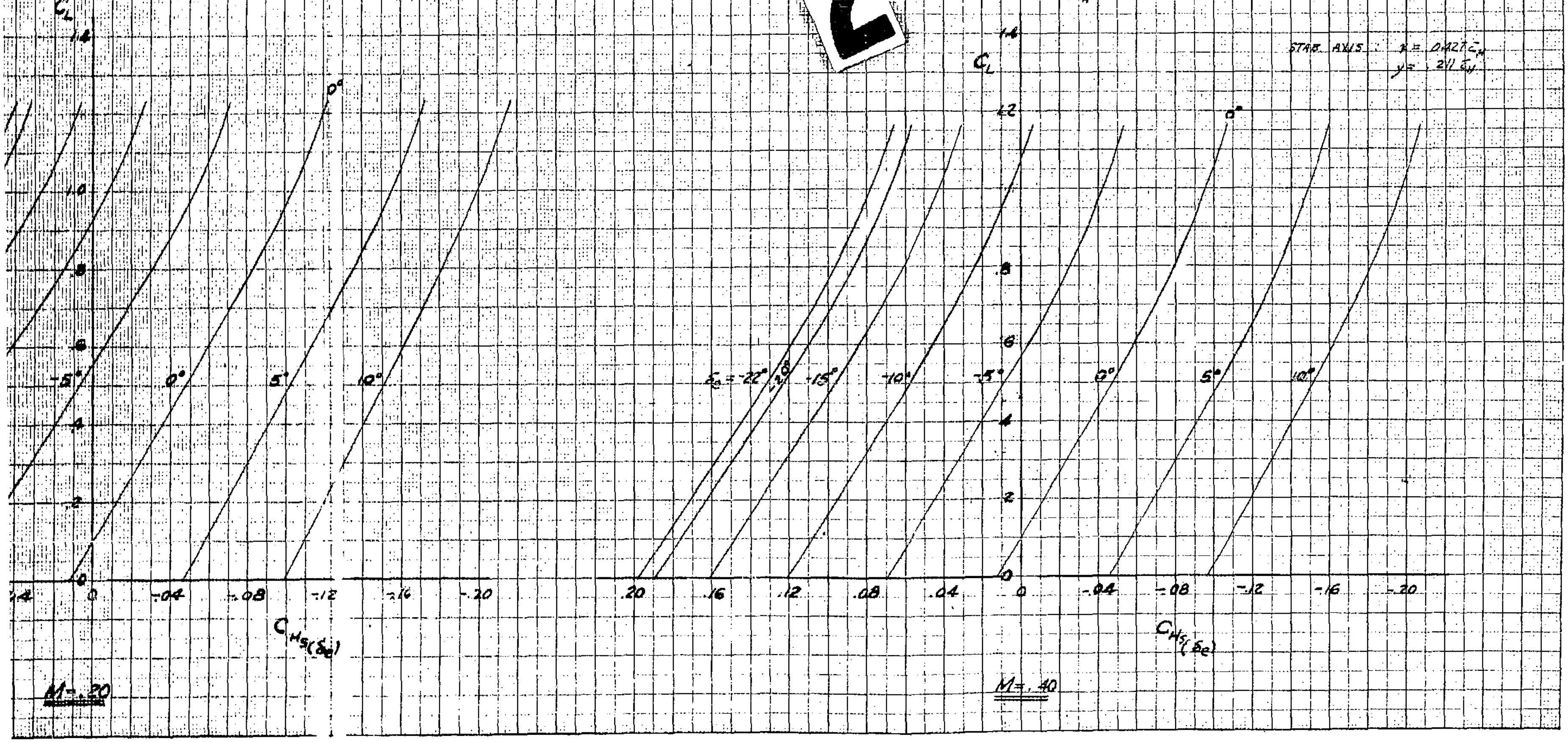
FIG. 15

VARIATION OF STABILIZER HINGE MOMENT WITH ELEVATOR DEFLECTION

ELEVATOR HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_S = 0°$
$S_H \bar{c}_H = 101.08\ FT^3$



PREPARED BY HTO		NORTH AMERICAN A
CHECKED BY FTG		
DATE: 1-19-50		ESTIMATED AERODYNAMIC (

VARIATION OF STABILIZER
WITH ELEVATOR DE

ELEVATOR HINGE LINE AT 7
SLATS FREE, $\delta_s = 0°$
$S_H \bar{c}_H = 101.08$ FT.^{3}

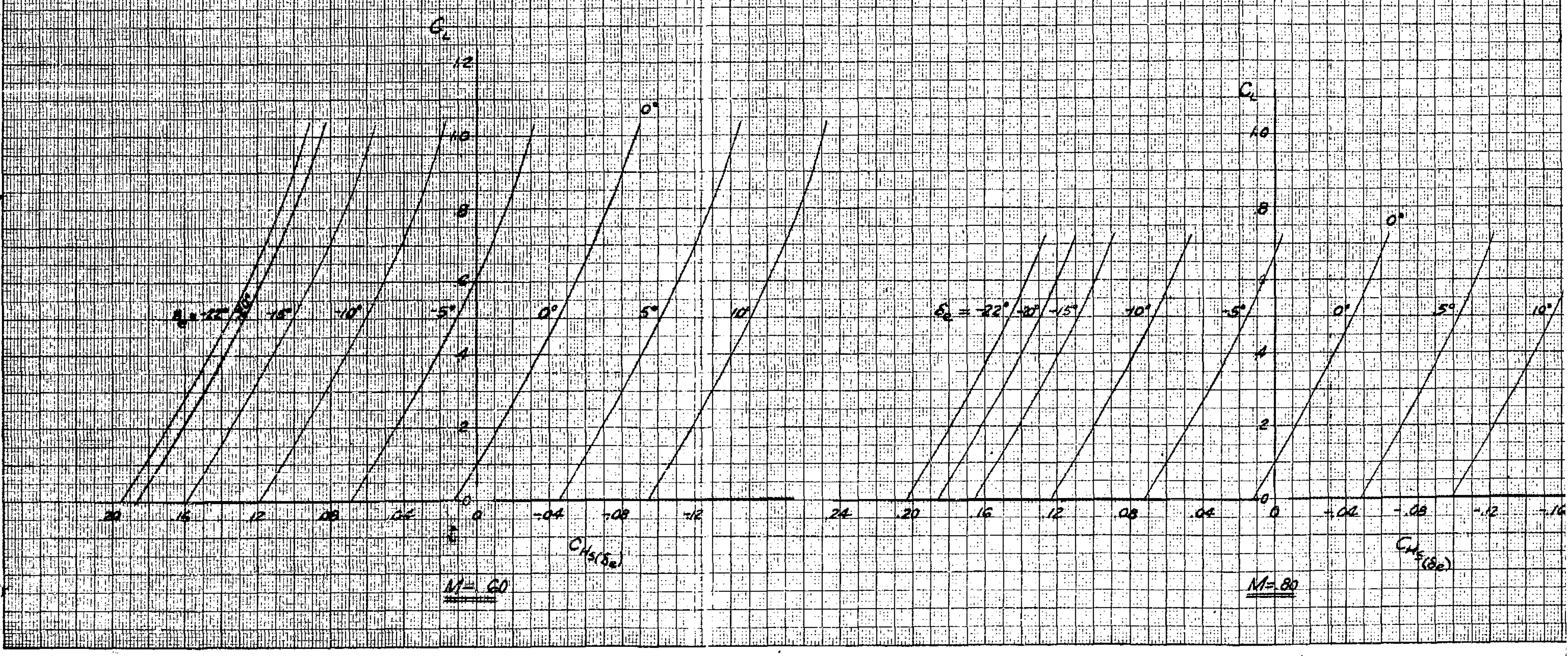
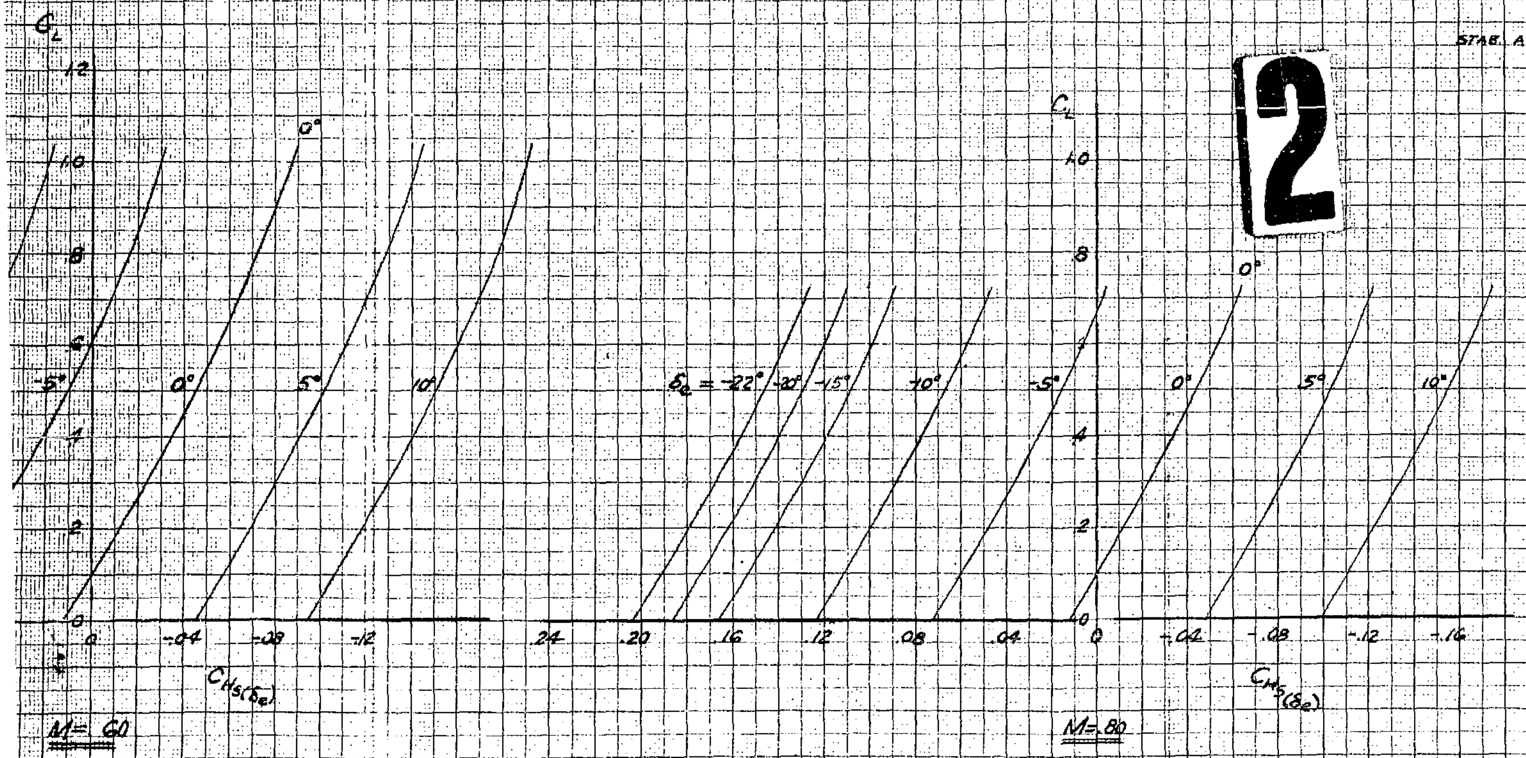


FIG. 16

VARIATION OF STABILIZER HINGE MOMENT WITH ELEVATOR DEFLECTION

ELEVATOR HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_S = 0°$
$S_H \bar{c}_H = 101.08\ FT^3$

STAB. AXIS: $x = .0427\ \bar{c}_H$
$y = .211\ \bar{c}_H$



North American A

Prepared by: HTO	
Checked by: FTG	
Date: 1-19-50	Estimated Aerodynamic

Variation of Stabilizer
With Elevator Defl

Elevator hinge line at 72
Slats free, $\delta_s = 0$

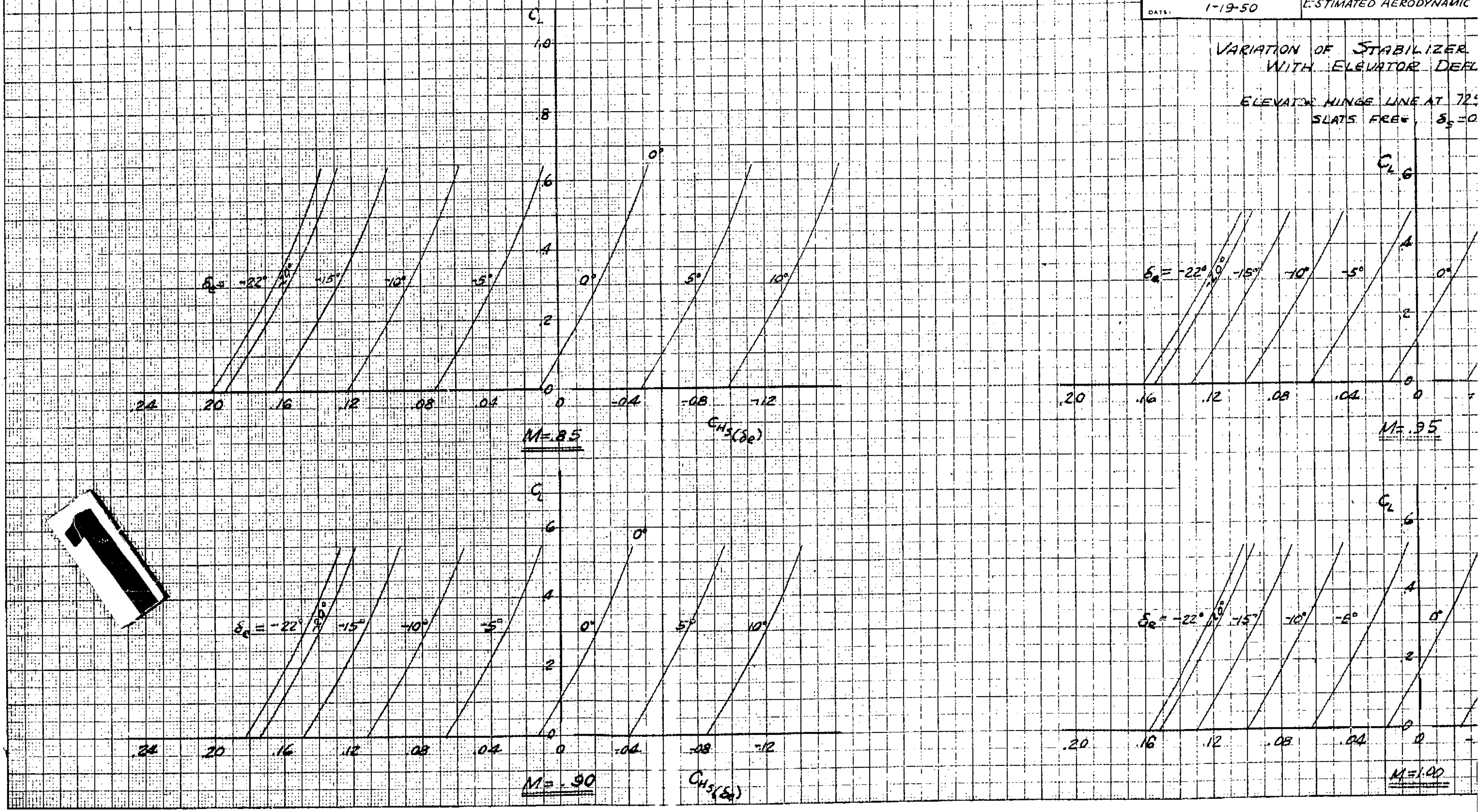


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FIG. 17

VARIATION OF STABILIZER HINGE MOMENT WITH ELEVATOR DEFLECTION

ELEVATOR HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_S = 0°$

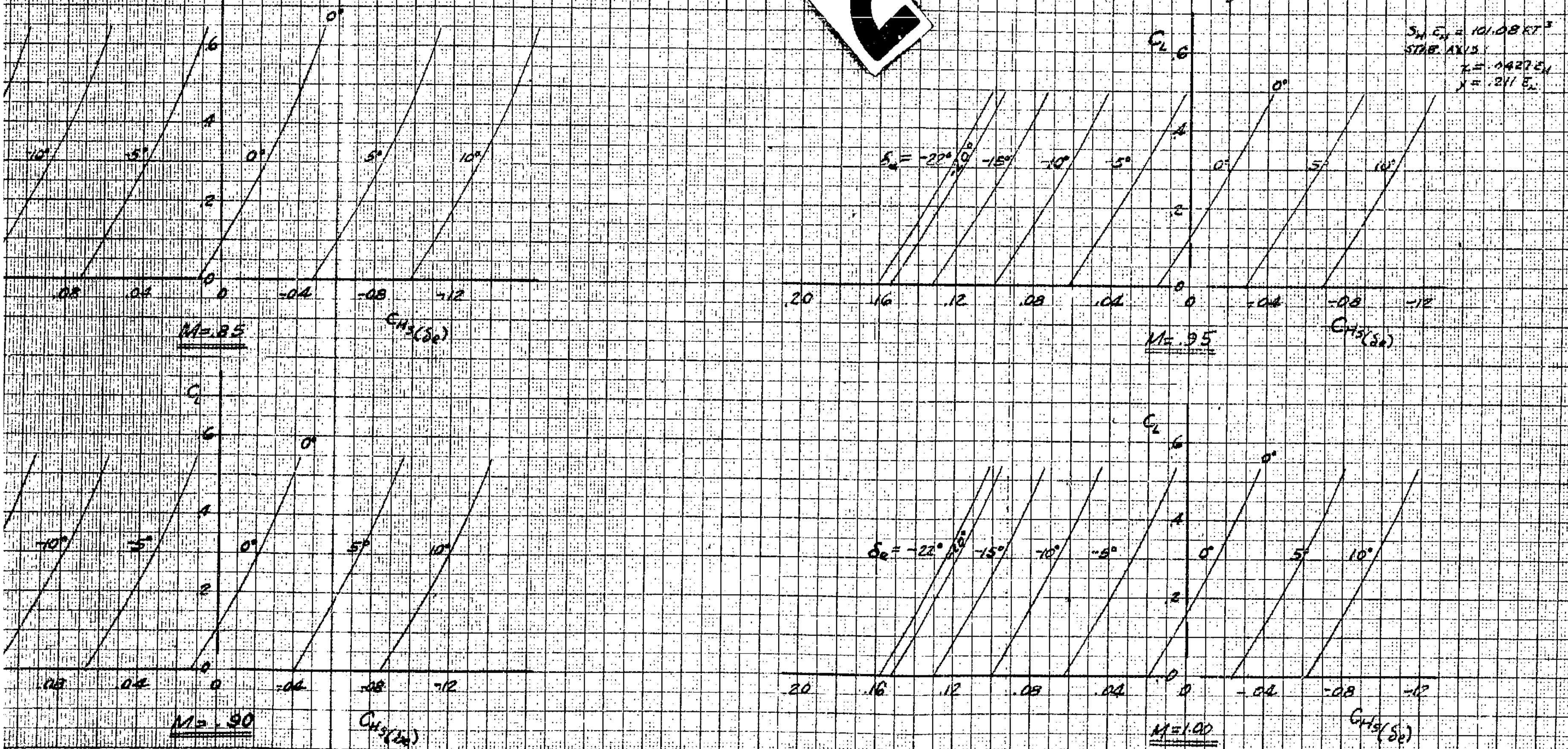
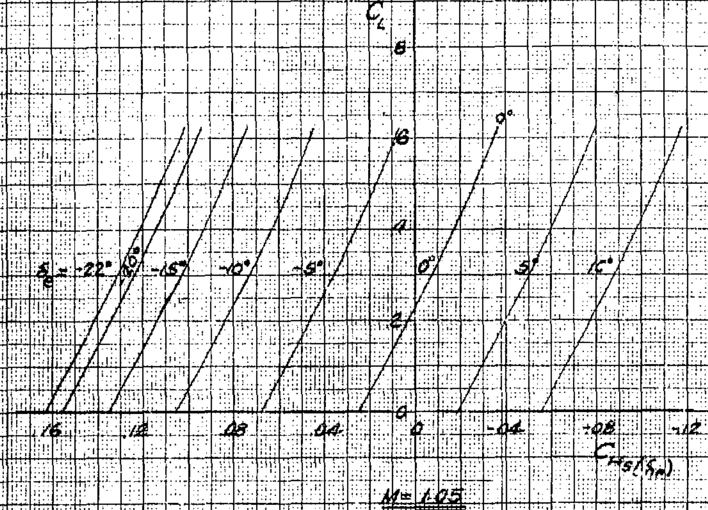


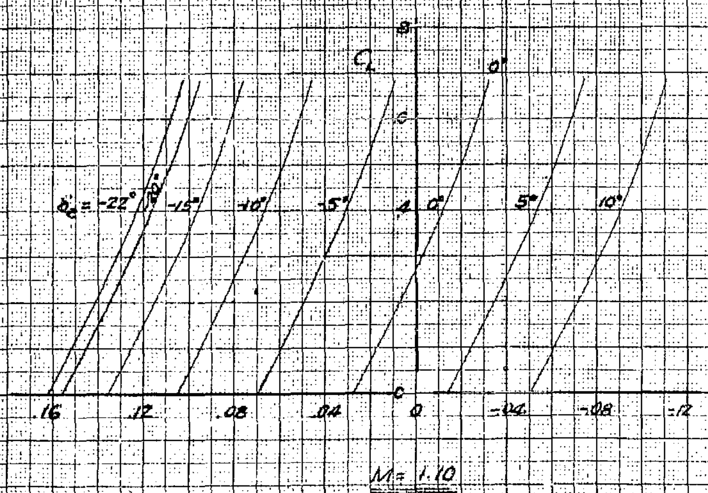
FIG 18

VARIATION OF STABILIZER HINGE MOMENT WITH ELEVATOR DEFLECTION

ELEVATOR HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_s = 0°$
$S_H \bar{c}_H = 101.08\ FT^3$

STAB AXIS: $x = .0427\ \bar{c}_H$
$y = .211\ \bar{c}_H$





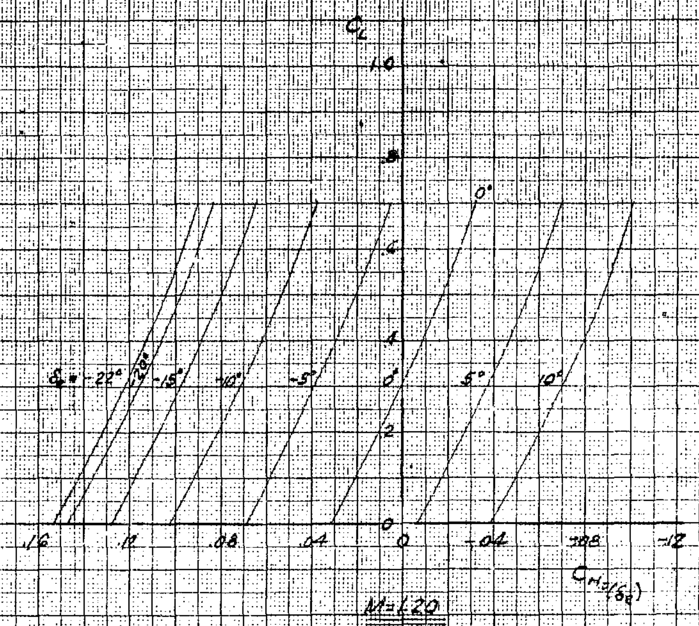


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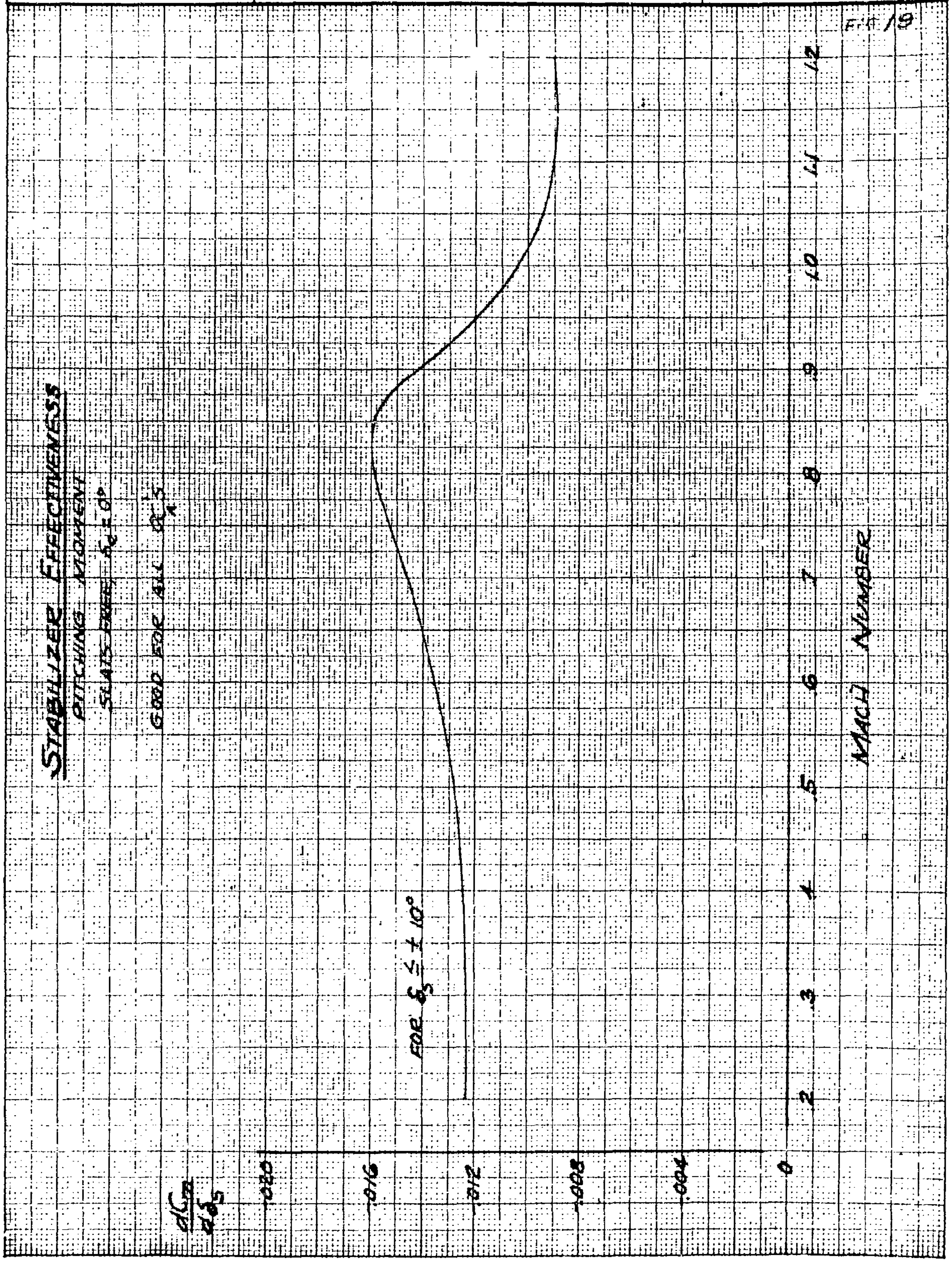
FIG 19



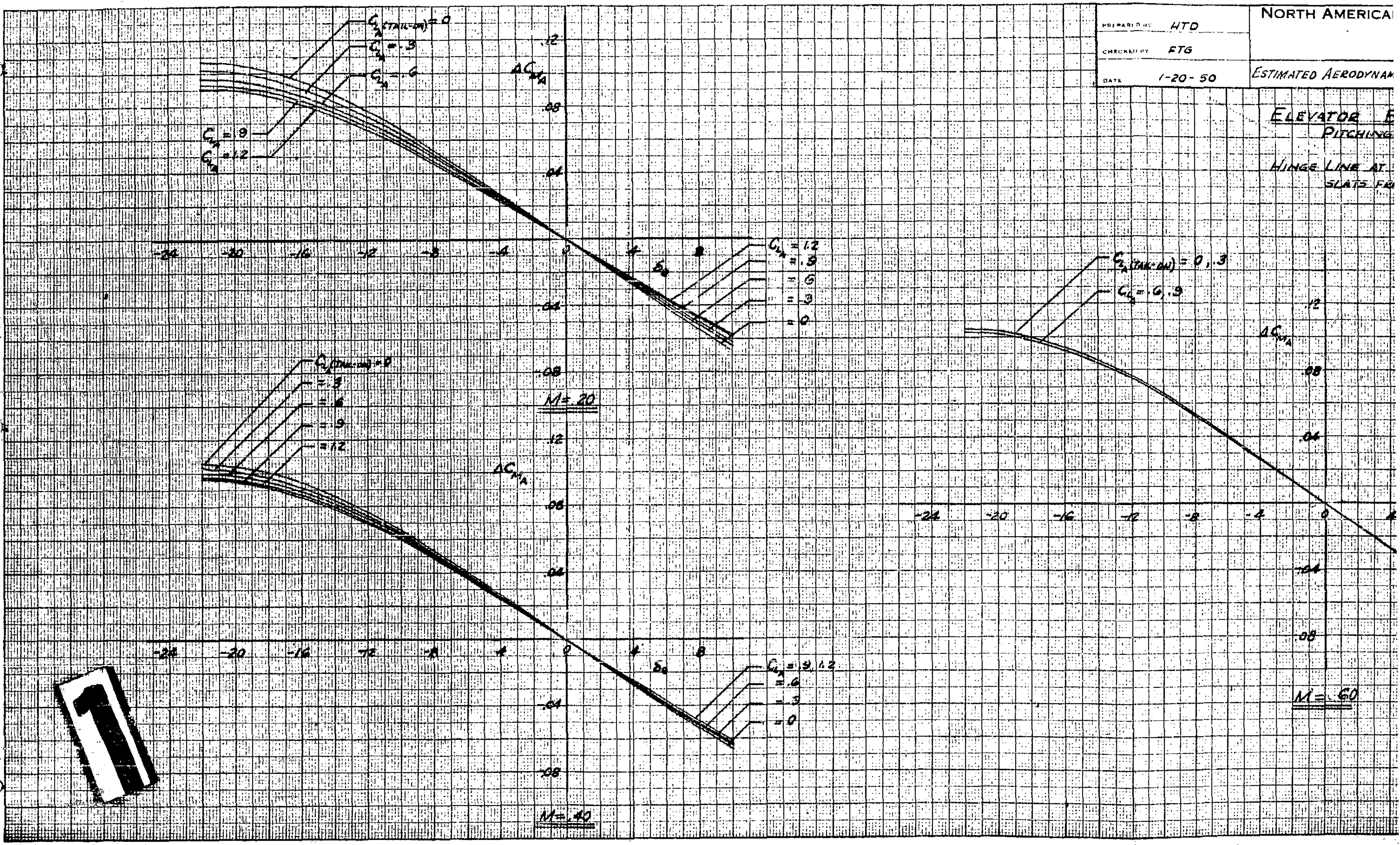
195-L "ALBANENE" TRACING PAPER - K. & E. CO., N. Y. - REG. U.S. PAT. OFF.

NORTH AMERICA[N]

PREPARED BY HTD
CHECKED BY FTG
DATE 1-20-50

ESTIMATED AERODYNAM[IC]

ELEVATOR E[...]
PITCHING[...]
HINGE LINE AT [...]
SLATS F[...]



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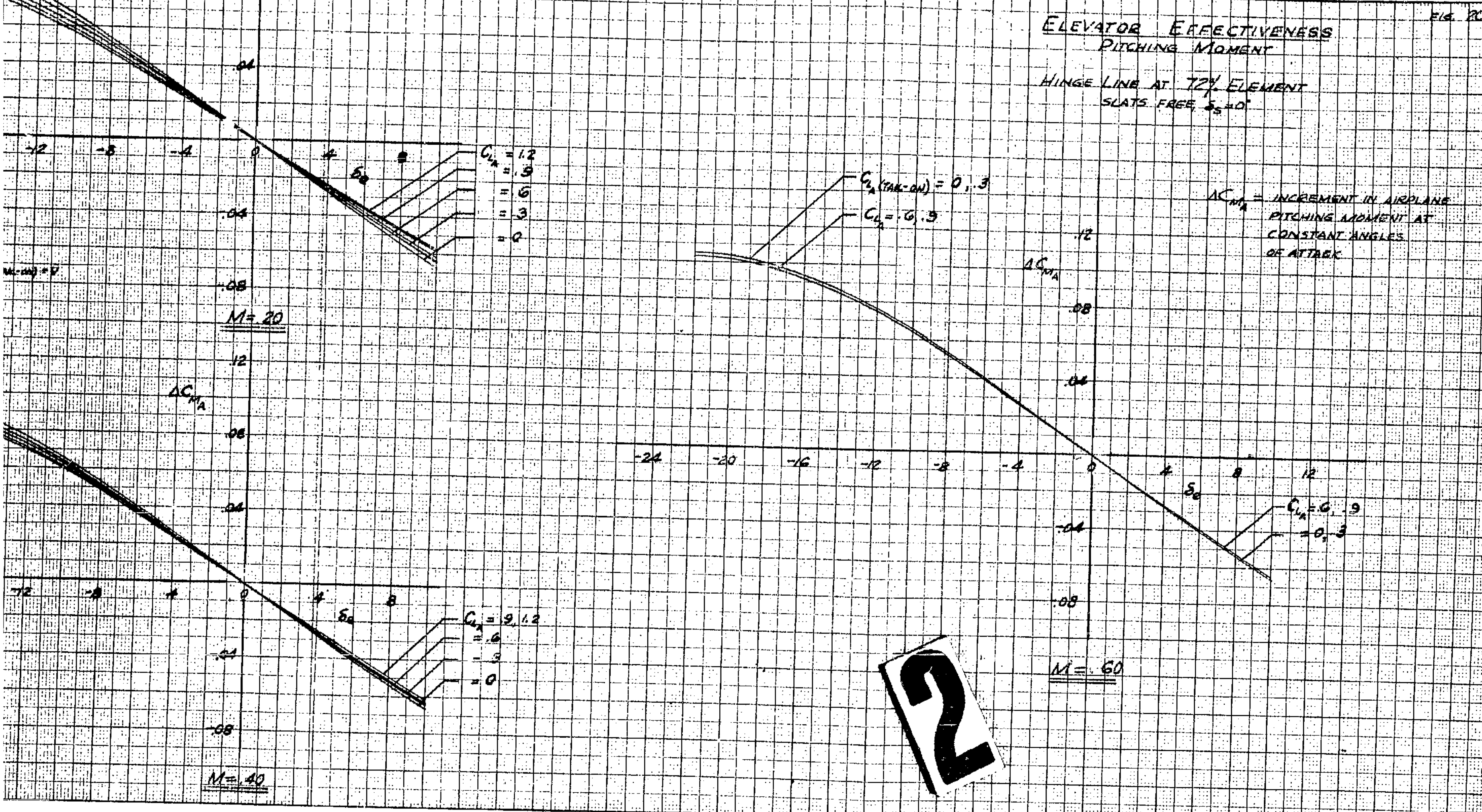


NORTH AME

PREPARED BY HTP
CHECKED BY FTG
DATE 1-20-50

ESTIMATED AER

ELEVATOR
PITCH

HINGE LIN
SLAT

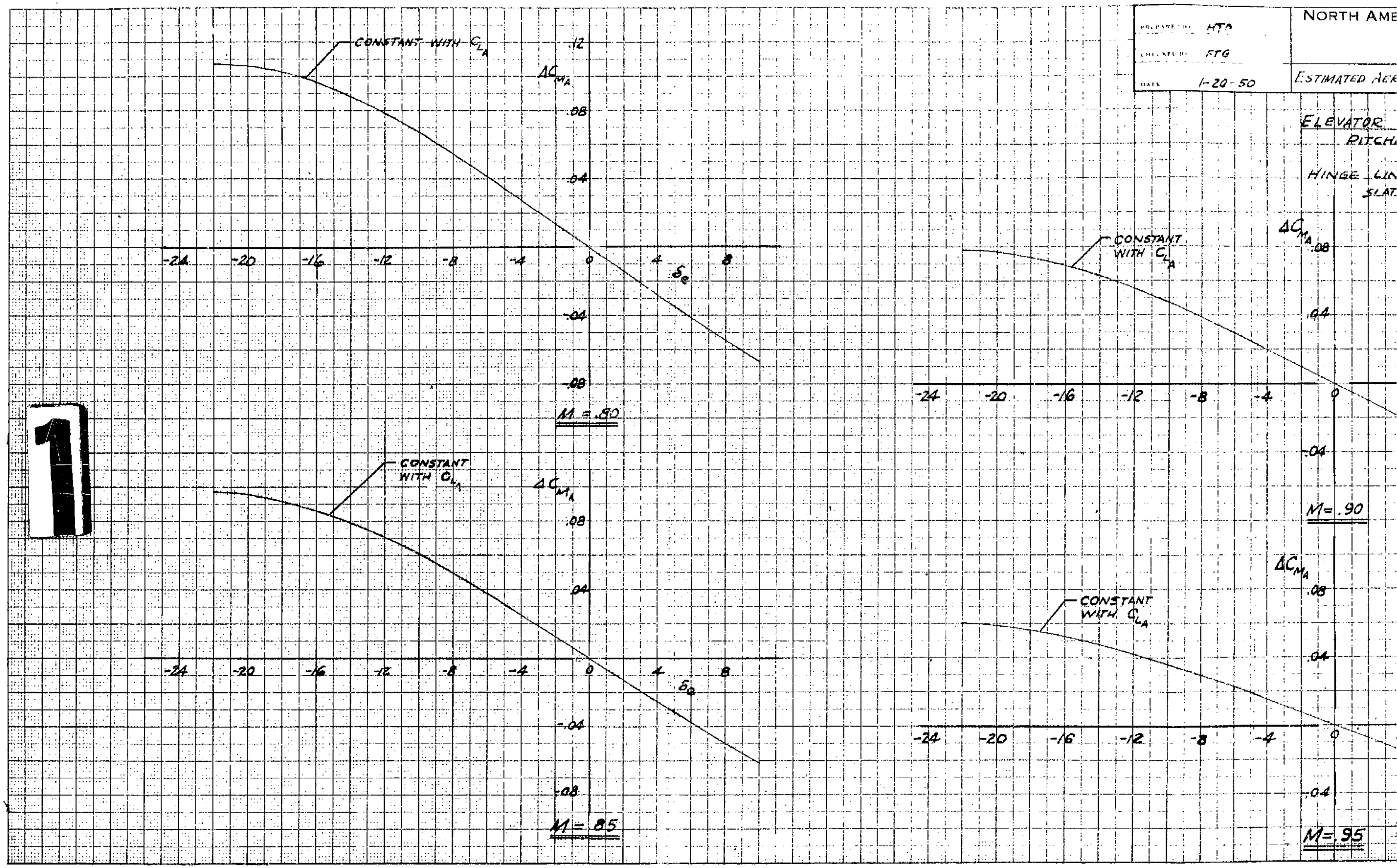
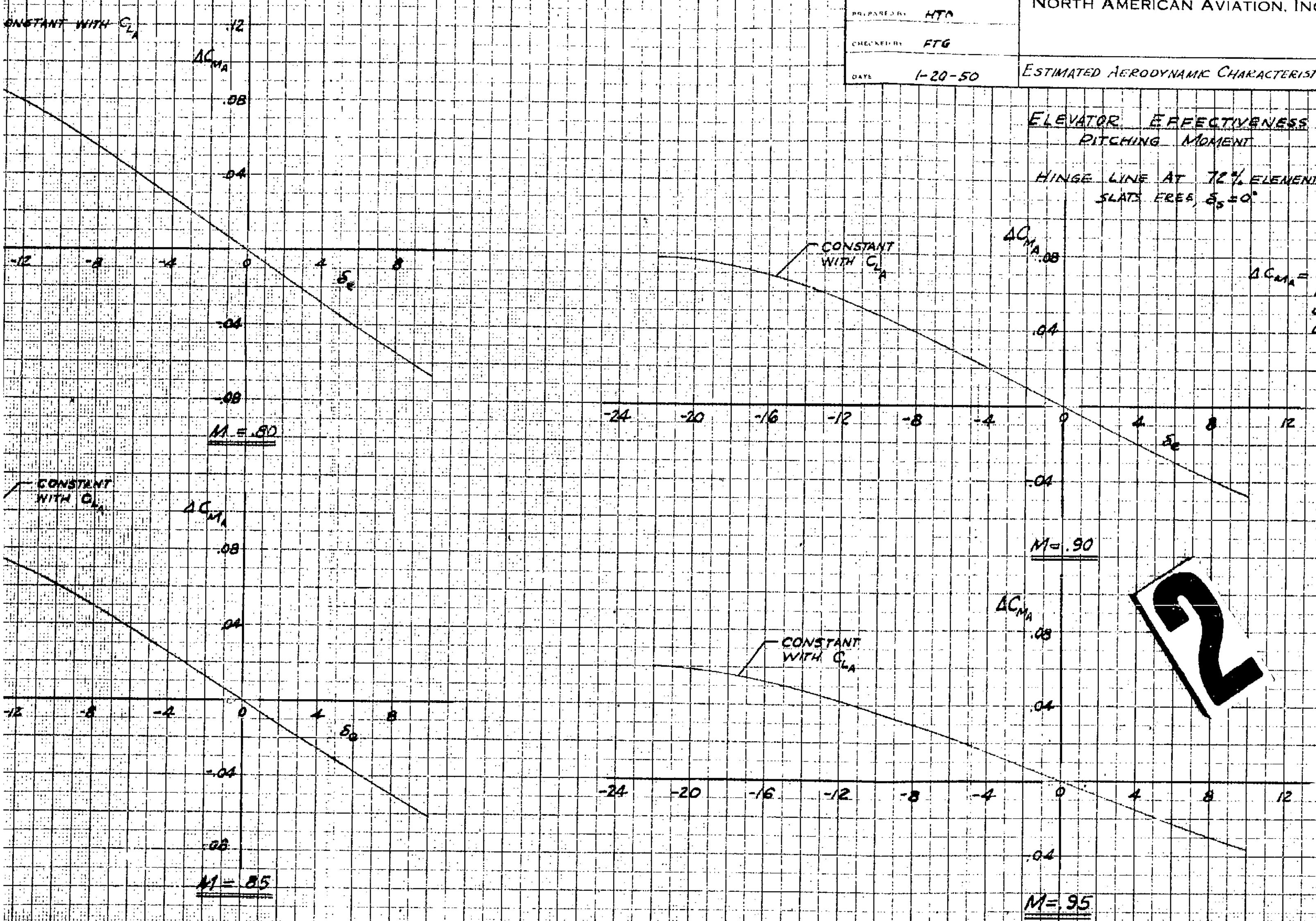


FIG. 21

ELEVATOR EFFECTIVENESS
PITCHING MOMENT

HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_s = 0°$

ΔC_{M_A} = INCREMENT IN AIRPLANE PITCHING MOMENT AT CONSTANT ANGLES OF ATTACK



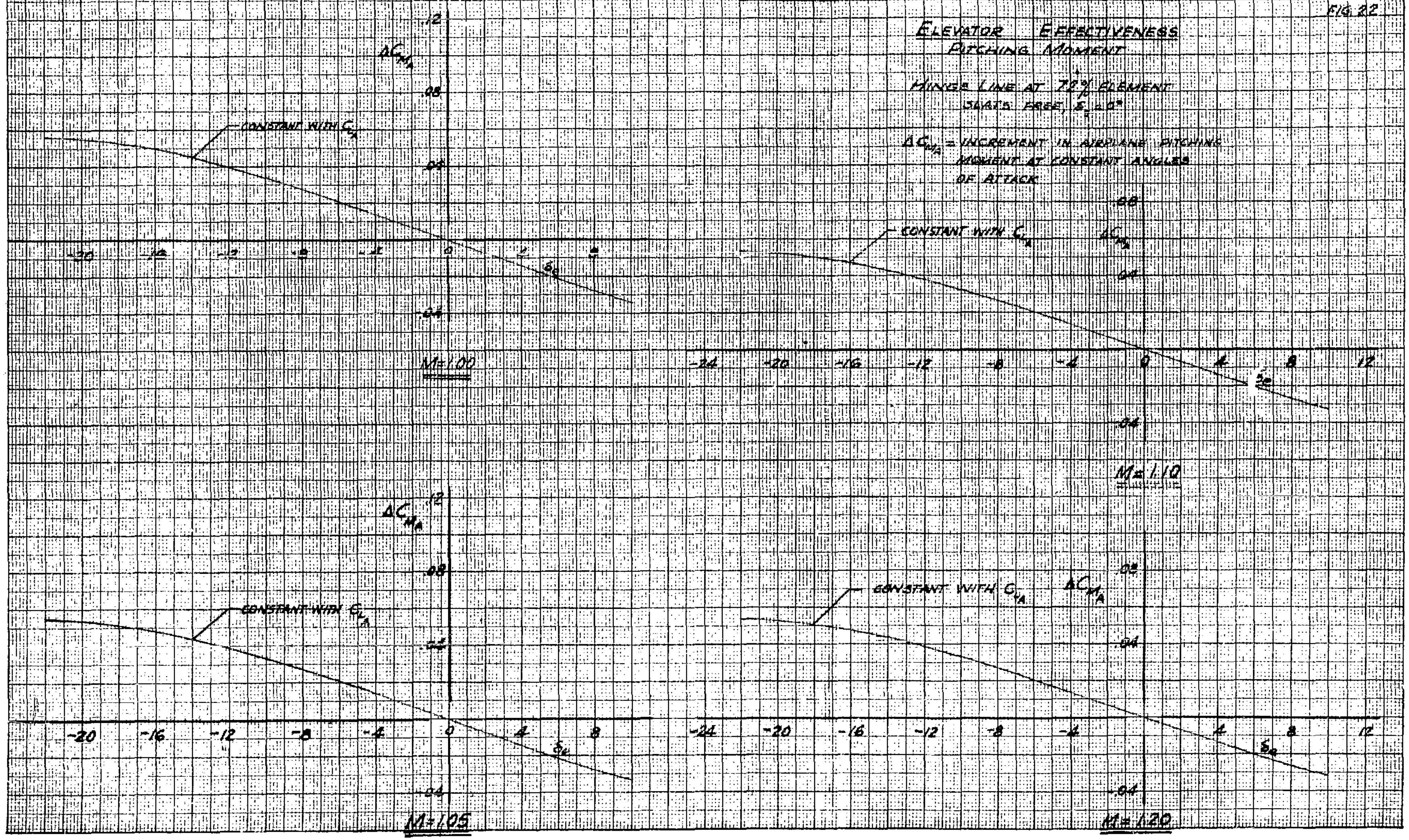


FIG. 22
ELEVATOR EFFECTIVENESS
PITCHING MOMENT
HINGE LINE AT 72% ELEMENT
SLATS FREE, $\delta_t = 0°$
ΔC_{M_A} = INCREMENT IN AIRPLANE PITCHING MOMENT AT CONSTANT ANGLES OF ATTACK
CONSTANT WITH C_{L_A}
ΔC_{M_A}
δ_e
M = 1.00
M = 1.05
M = 1.10
M = 1.20

FORM ED-140

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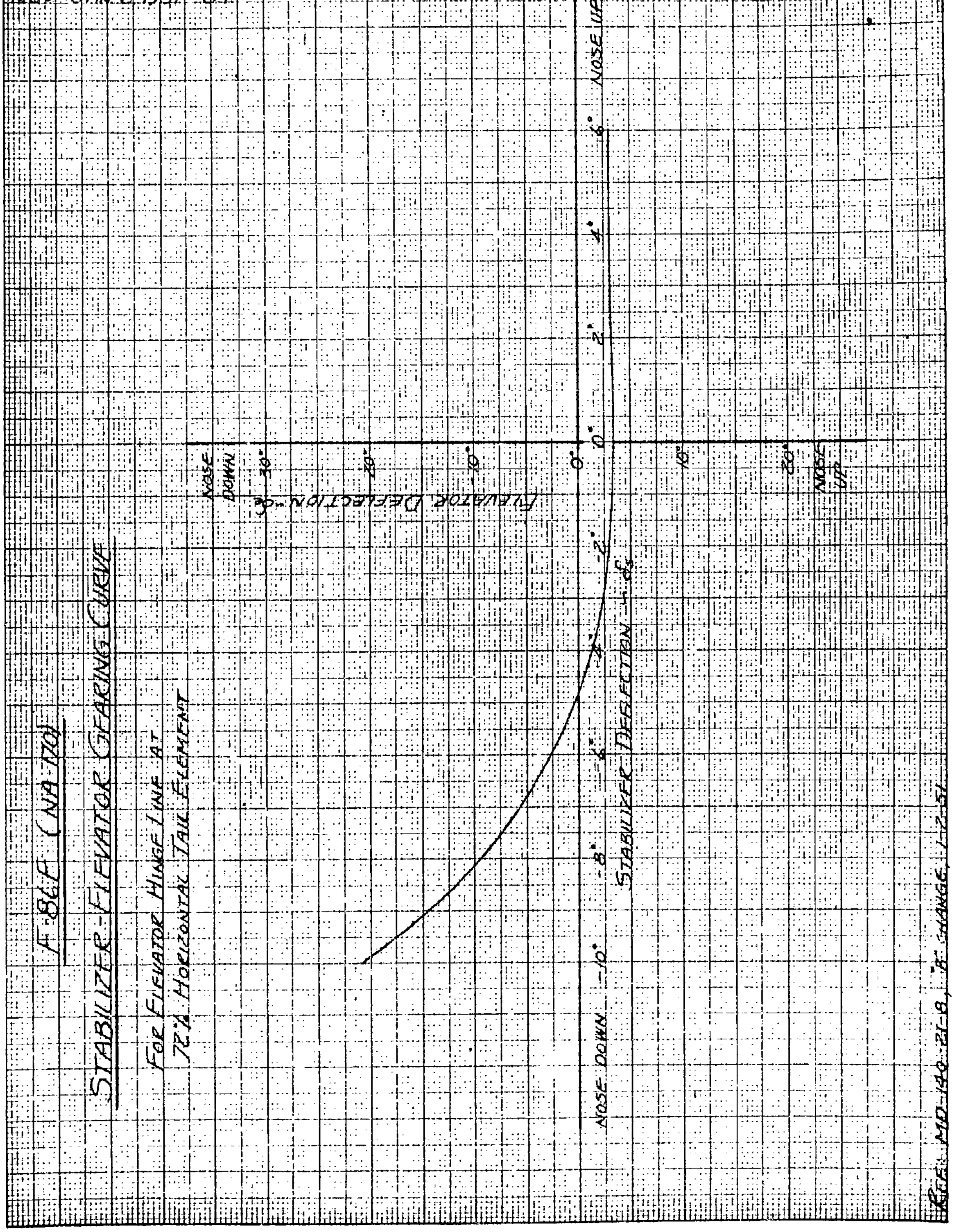
DATE: 1-27-50		MODEL NO. F-86E

30L-

REV JAN 8 1951 G.P.

FIG. 23



PREPARED BY: PES
CHECKED BY: LPG
DATE: 2-11-48

NORTH AM[...] INC

ESTIMATED A[...]

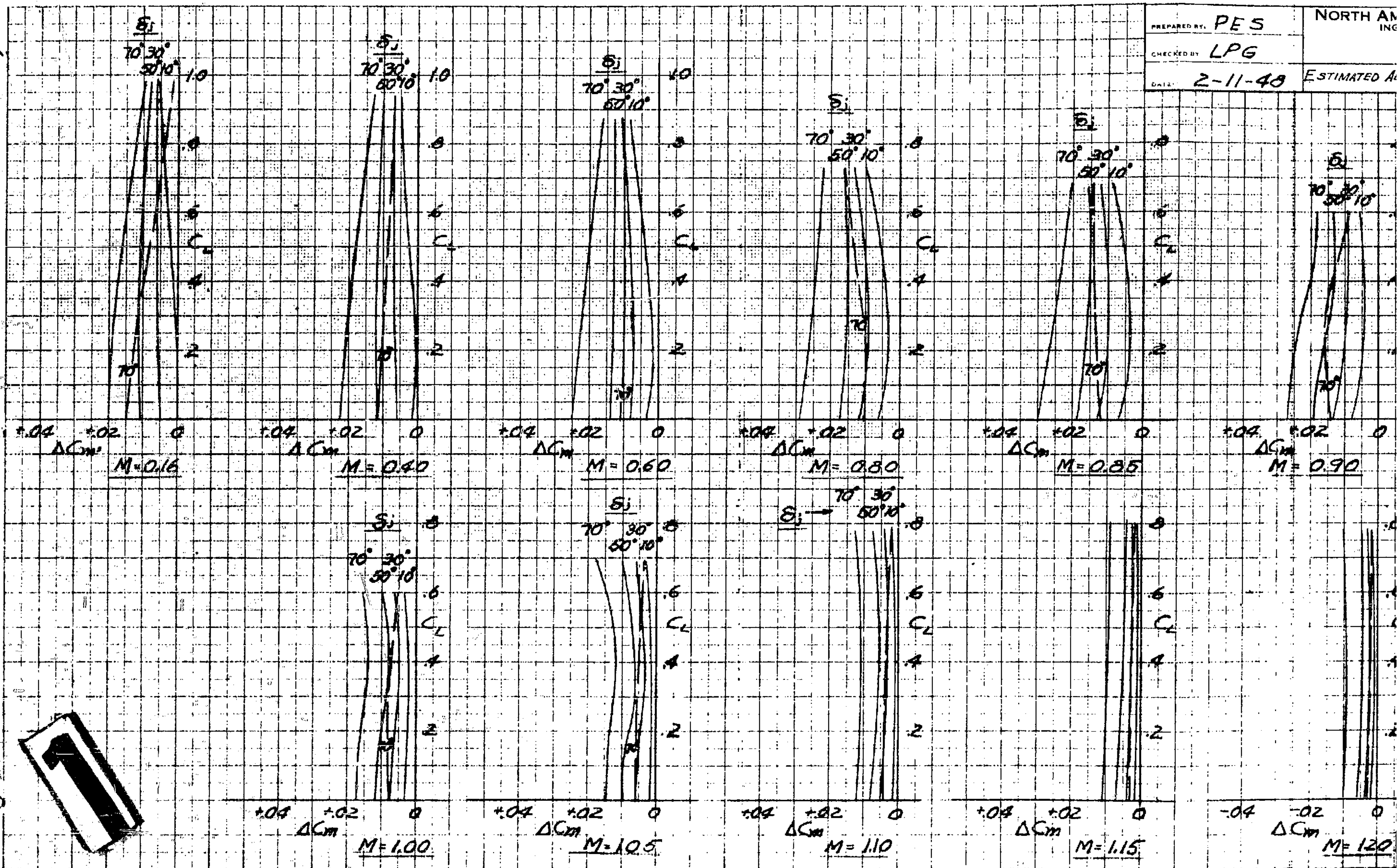
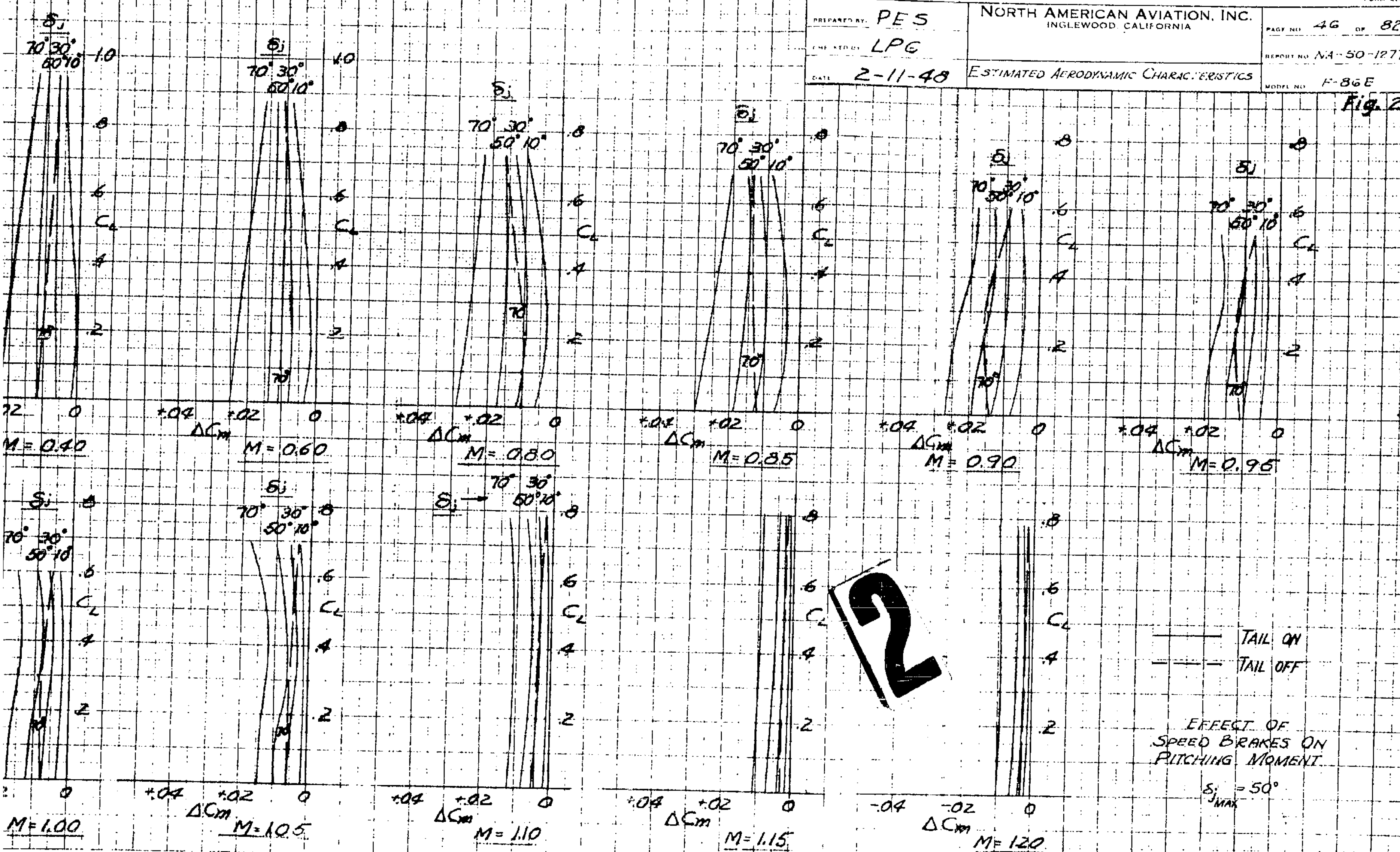
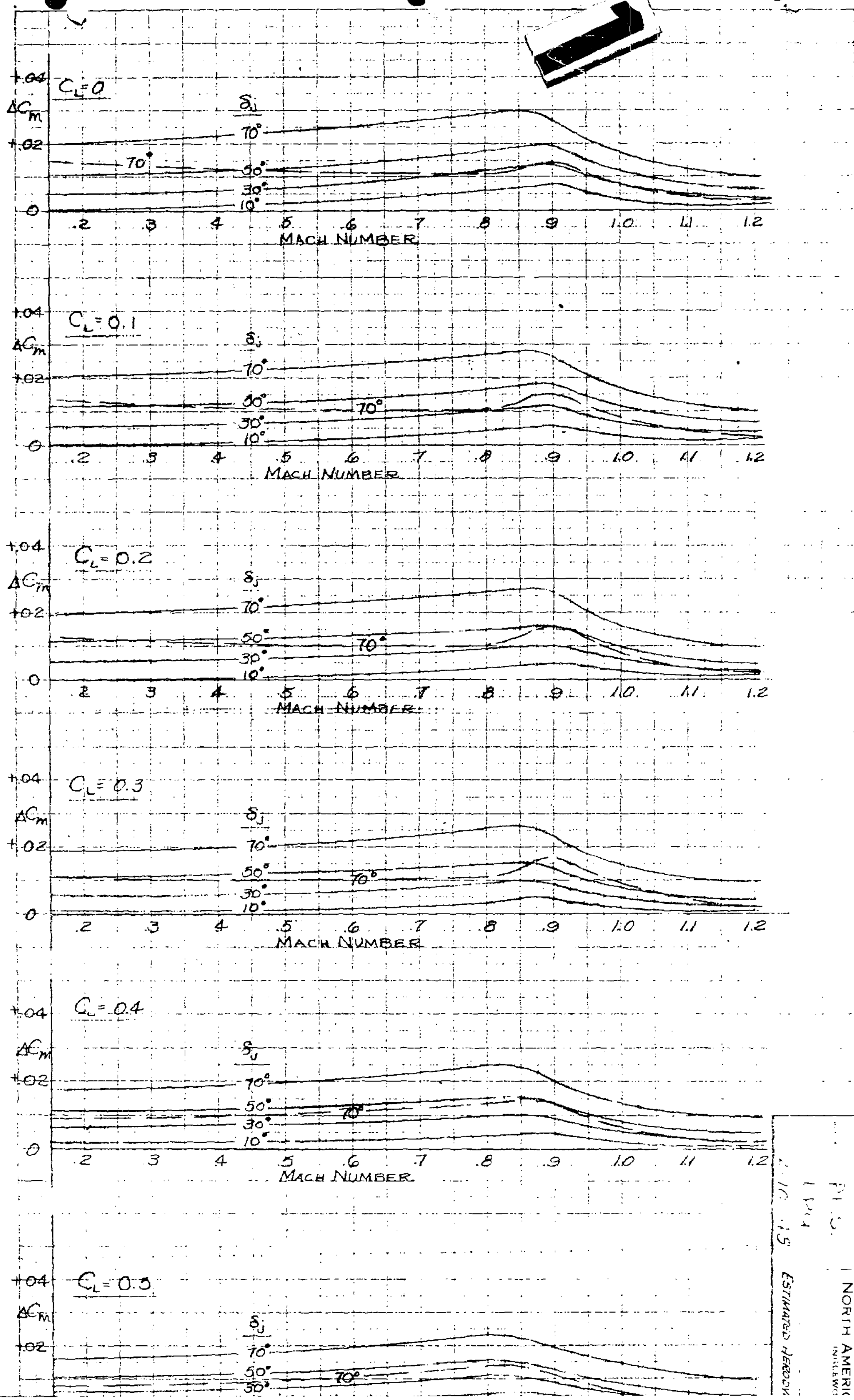


Fig. 24



EFFECT OF SPEED BRAKES ON PITCHING MOMENT

$\delta_{j_{MAX}} = 50°$



NORTH AMERIC
INGLEWO

ESTIMATED AERODY

North American Aviation, Inc.
Inglewood California

P.E.S.
L.P.G.
2-10-49

Estimated Aerodynamic Characteristics

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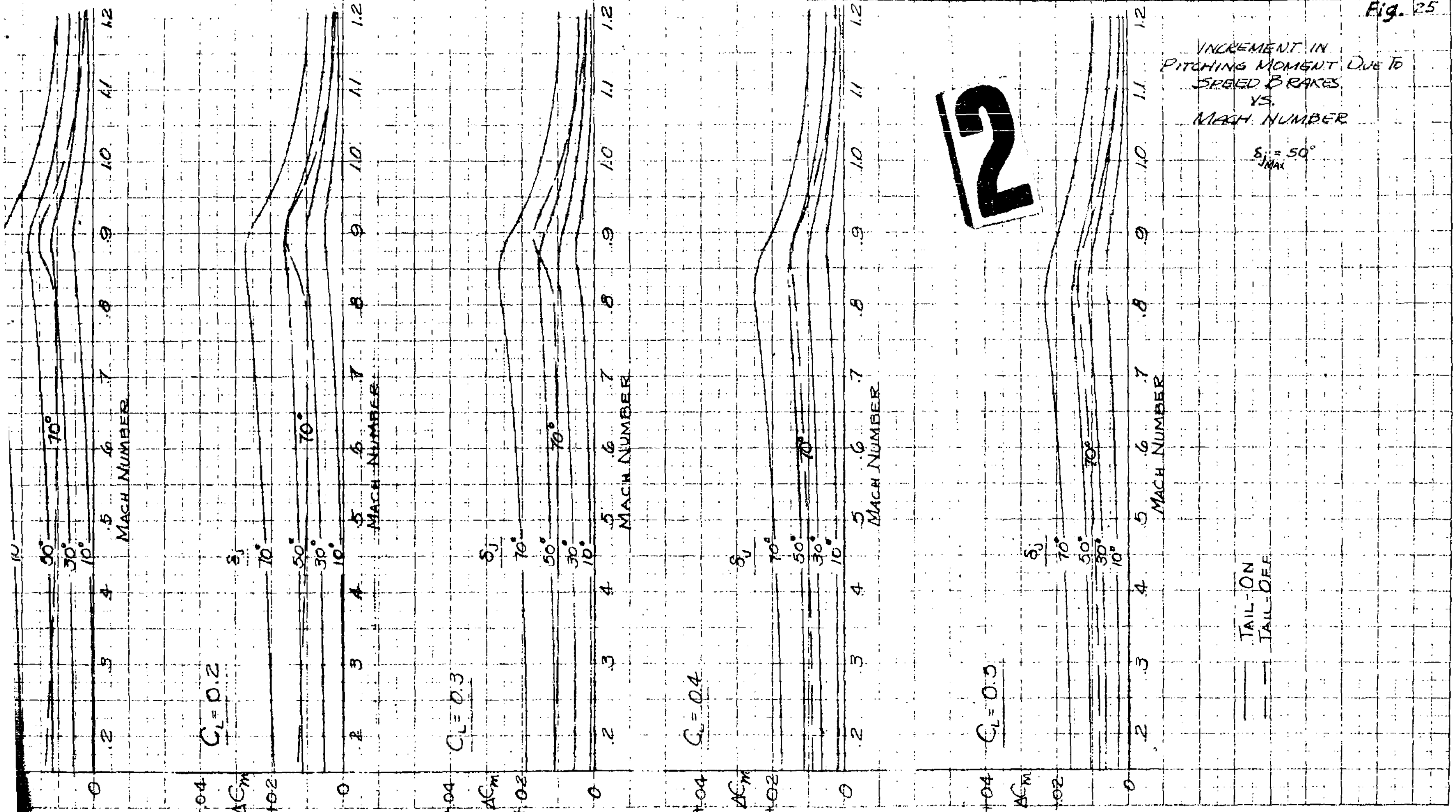
F-86E

Fig. 25



PREPARED BY PES.

CHECKED BY LPG

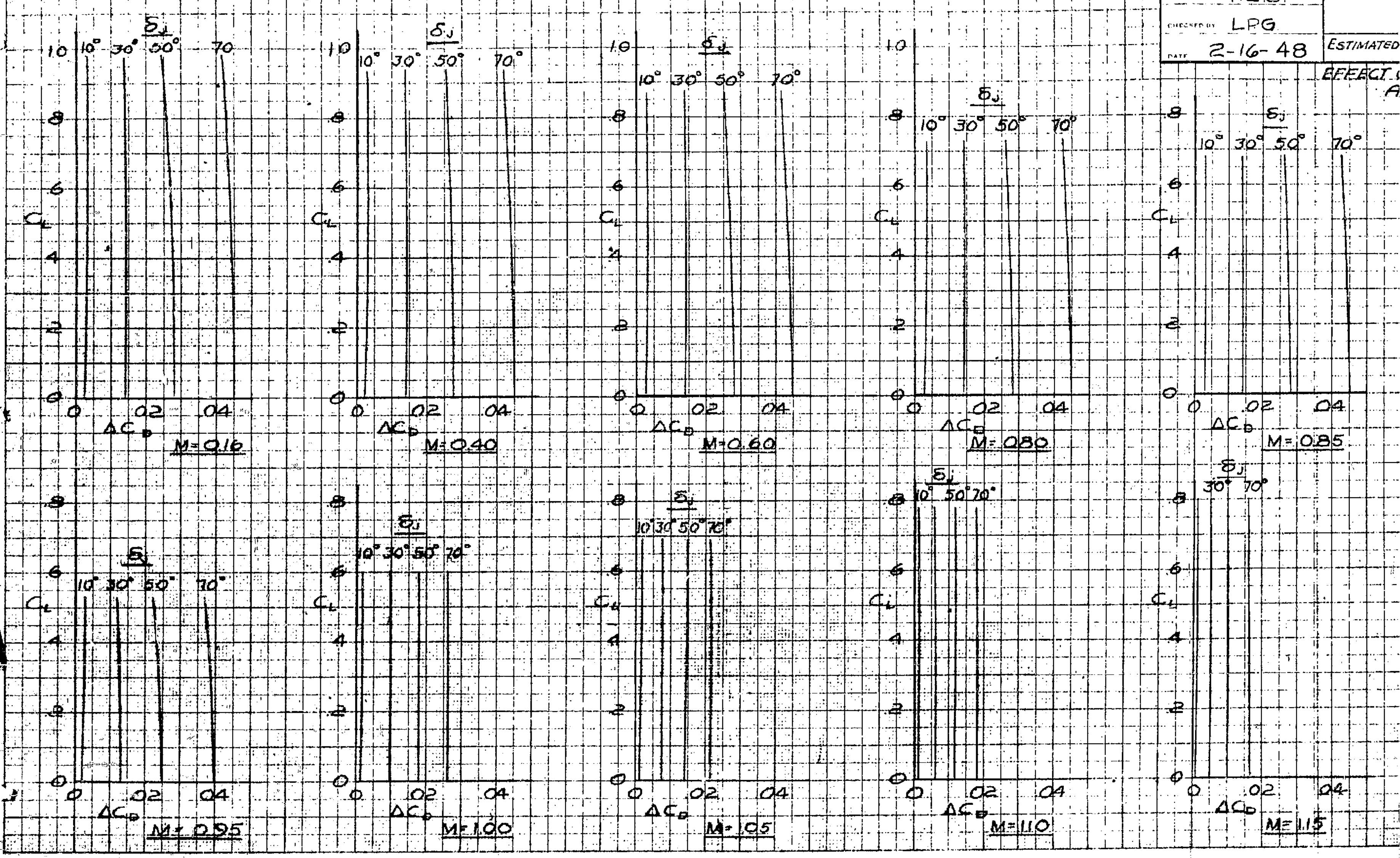
DATE 2-16-48

NORTH

ESTIMATED

EFFECT

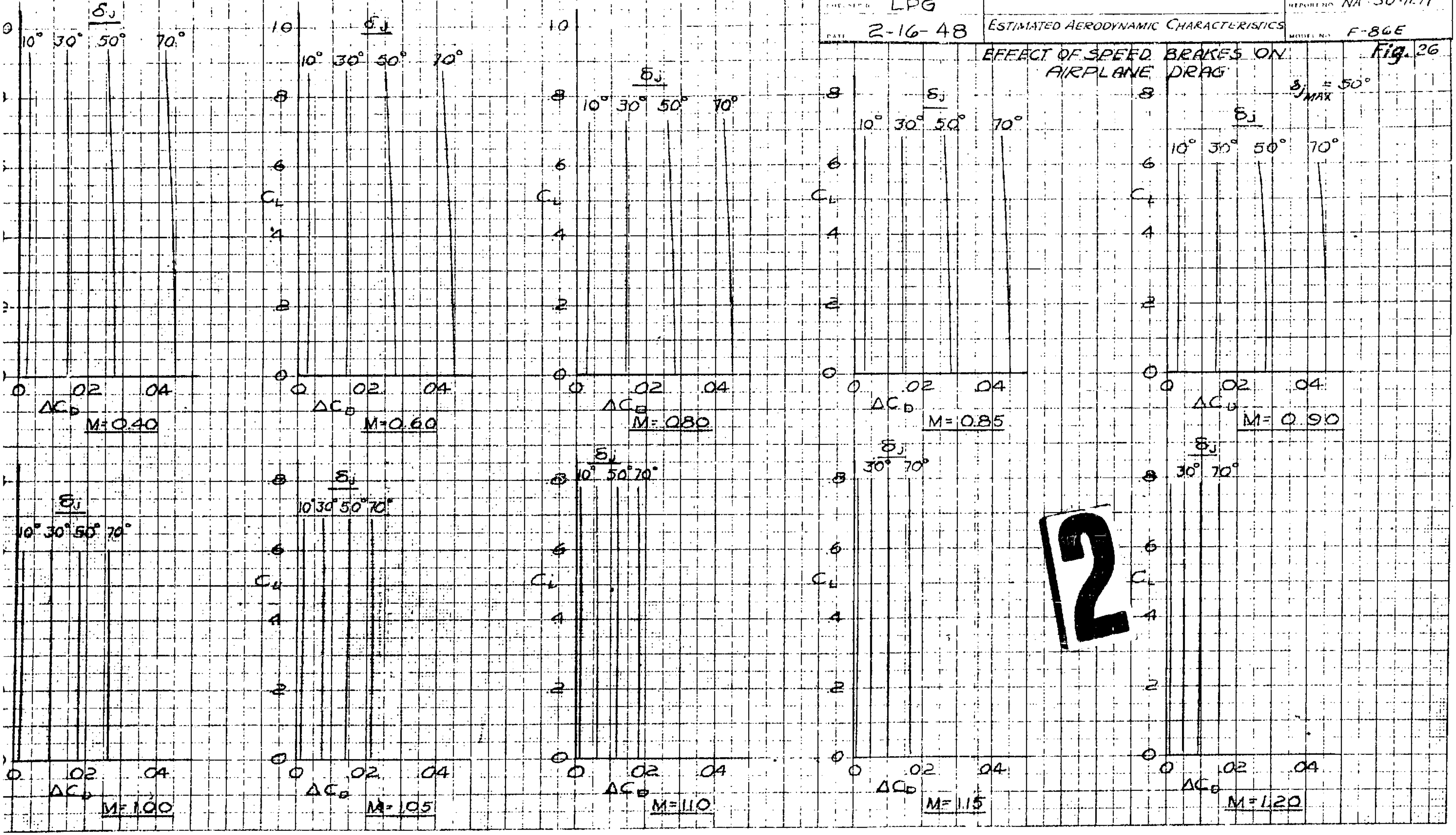
A



PREPARED BY PES CHECKED BY LPG DATE 2-16-48	NORTH AMERICAN AVIATION, INC. INGLEWOOD, CALIFORNIA ESTIMATED AERODYNAMIC CHARACTERISTICS	PAGE NO. 48 OF 82 REPORT NO. NA-50-1277 MODEL NO. F-86E

EFFECT OF SPEED BRAKES ON AIRPLANE DRAG

Fig. 26



PREPARED BY: PES	NORTH AMERICAN AVIATION, INC. INGLEWOOD, CALIFORNIA	PAGE NO 49 OF 82
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FIG 27

INCREMENT IN DRAG DUE TO SPEED BRAKES VS. MACH NUMBER

$\delta_{J_{MAX}} = 50°$

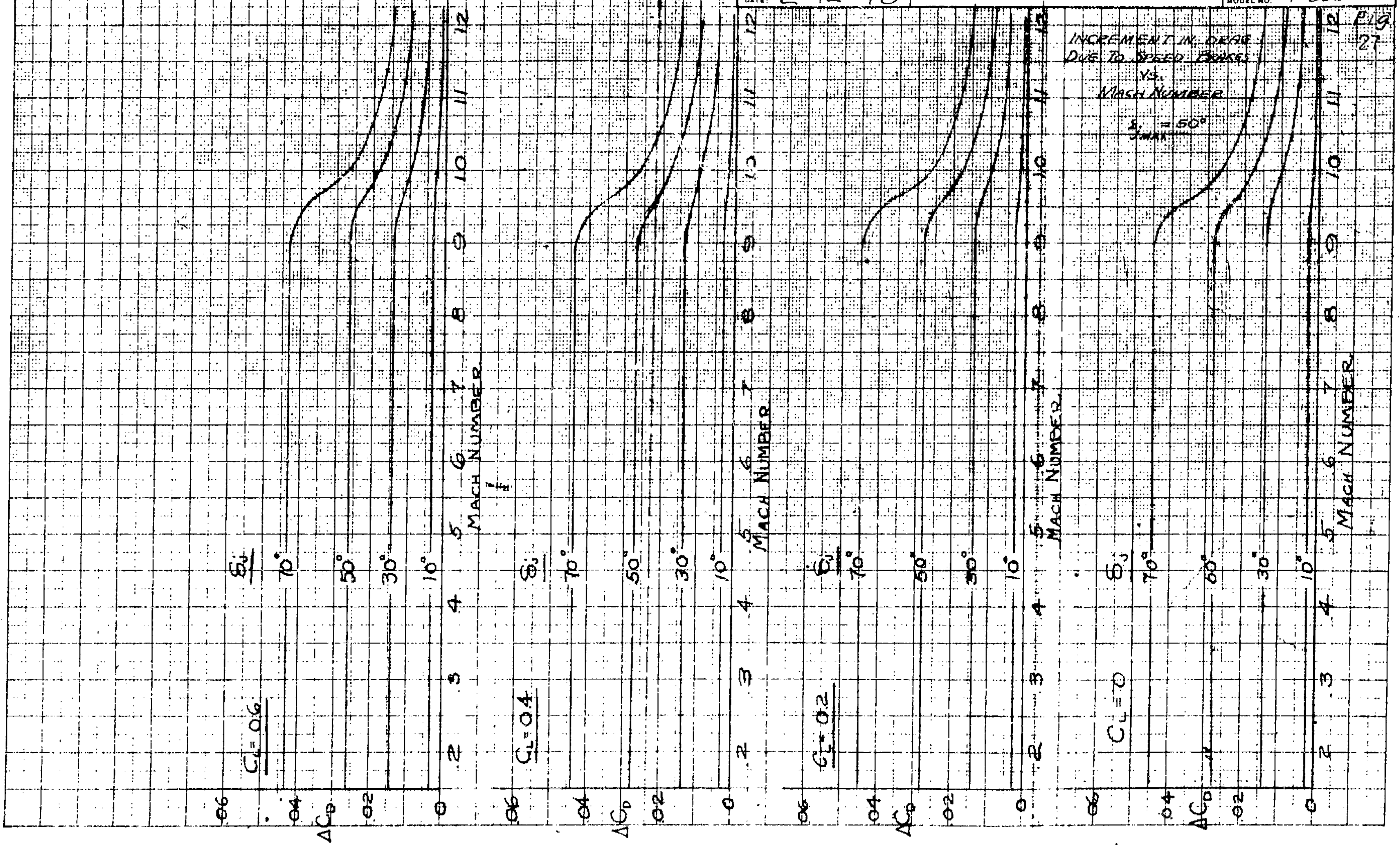


FIG. 28

F-86E

ESTIMATED INCREMENT OF DRAG COEFFICIENT DUE TO ONE 120 GAL. EXTERNAL FUEL TANK WITH FIN

$\alpha = 0°$

$\Delta C_{D_{TANK}} = \Delta D / qS$ WHERE: ΔD = DRAG INCREMENT

S = WING AREA = 288 SQ. FT.

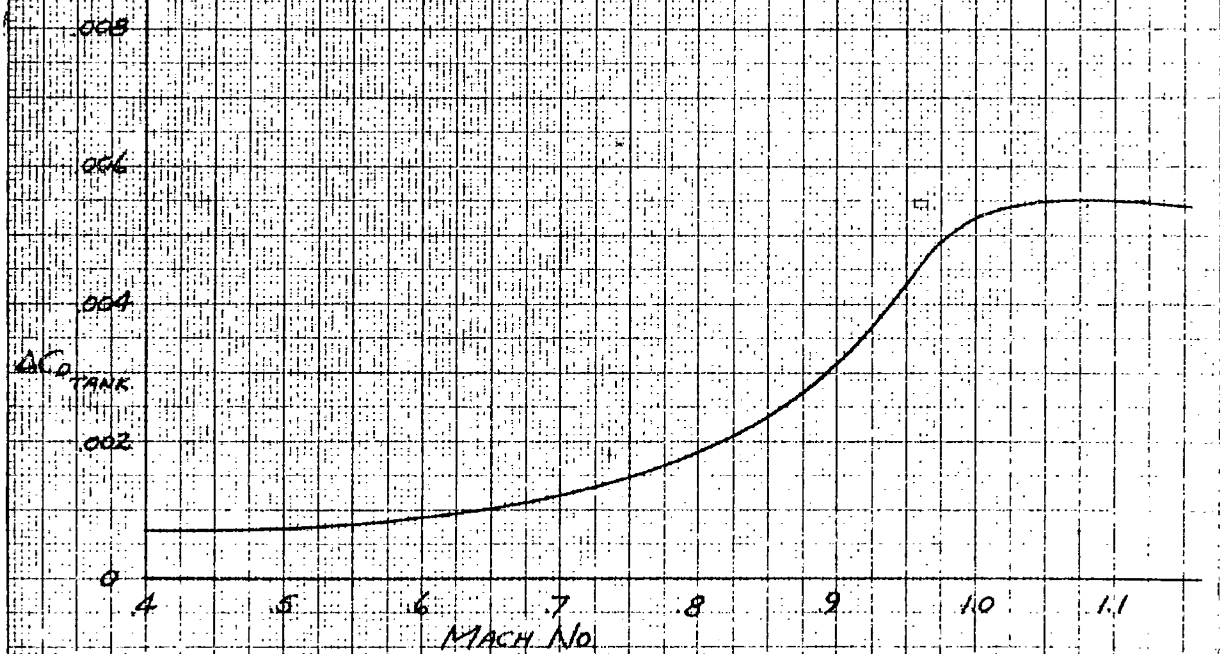


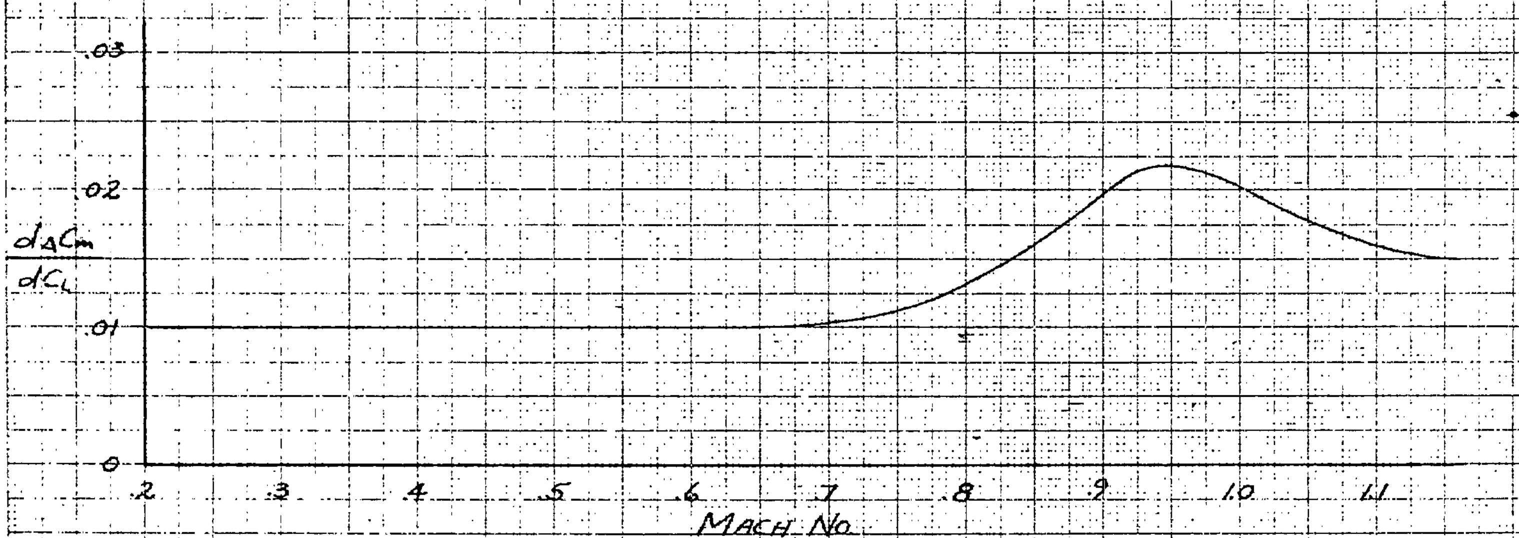
FIG. 29

F-86E

ESTIMATED VARIATION OF $d\Delta C_m/dC_L$ WITH MACH NO
DUE TO 120 GALLON EXTERNAL FUEL TANKS WITH FINS

$\Delta C_m = \dfrac{\Delta M}{q S \bar{c}_w}$ WHERE: ΔM = MOMENT INCREMENT DUE TO TWO TANKS
S = WING AREA
$\bar{c}_w$ = WING M.A.C.

$\Delta C_{m_{0\,TANK}} = 0$



PREPARED BY: G.P.	NORTH AMERICAN AVIATION, INC.		PAGE NO. 52 OF 82
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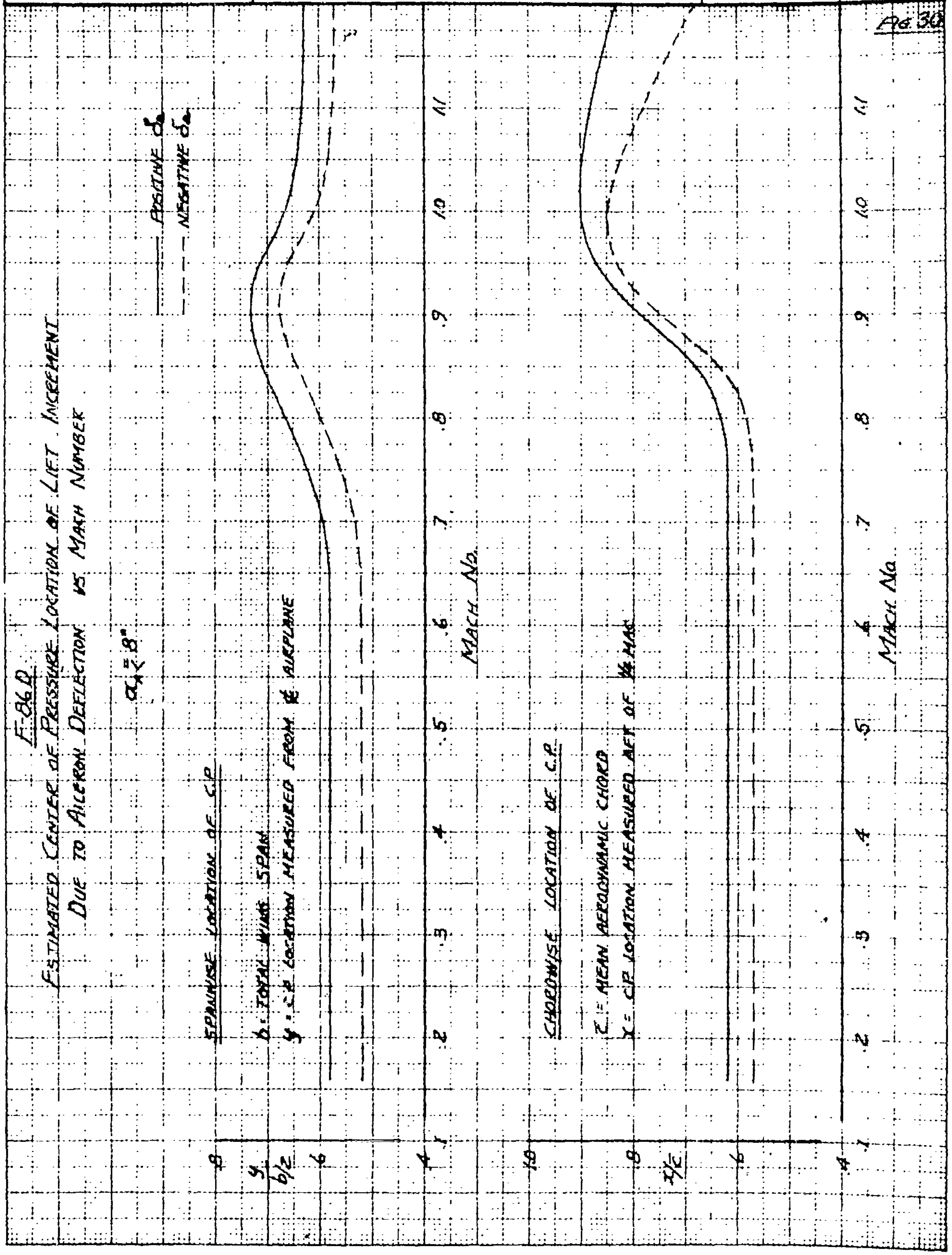
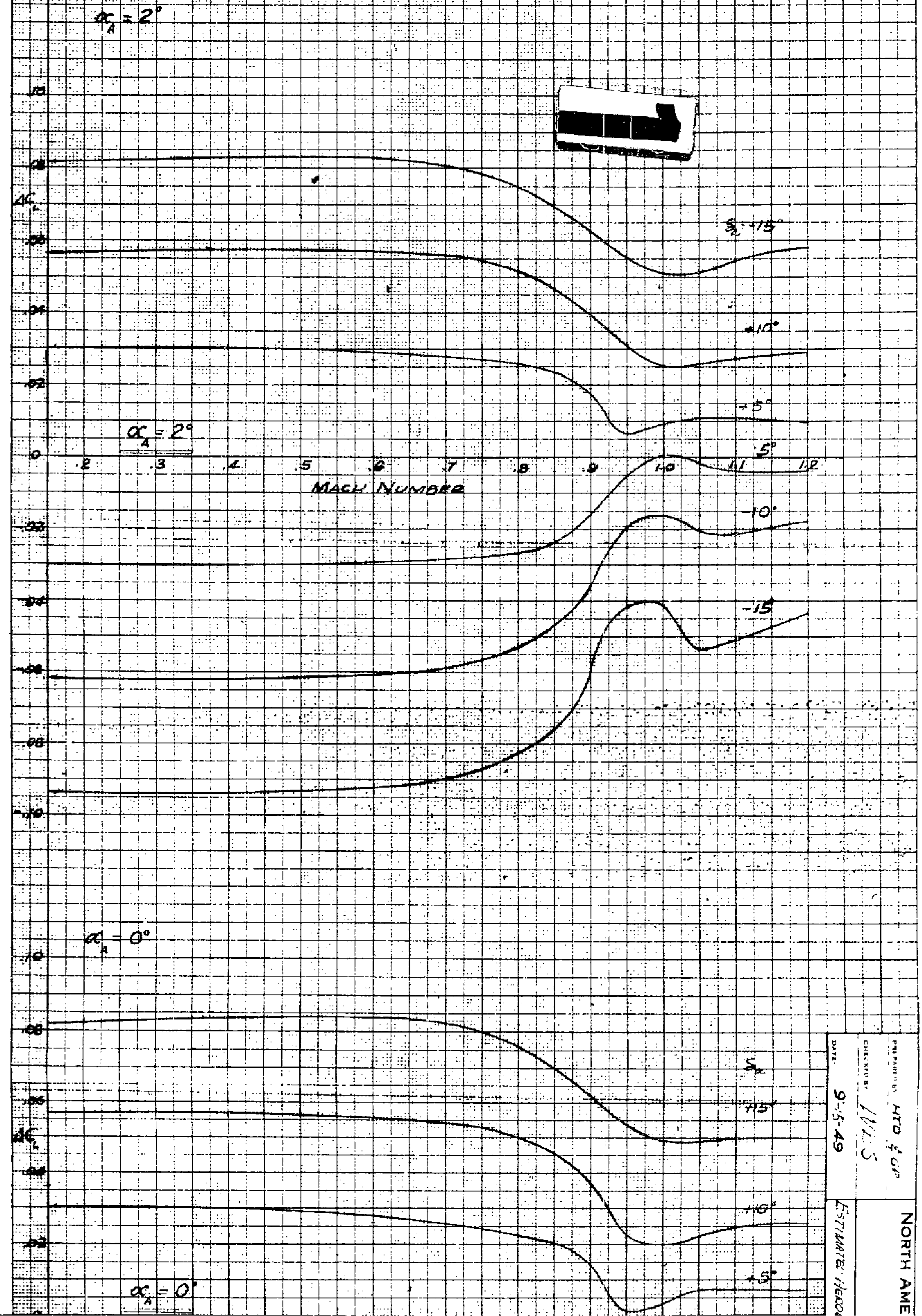
DATE: SEPT 15, 1949	ESTIMATED AERODYNAMIC CHARACTERISTICS		MODEL NO. F-86E



ESTIMATED INCREMENT OF LIFT COEFFICIENT
DUE TO AILERON DEFLECTION
(ONE AILERON)

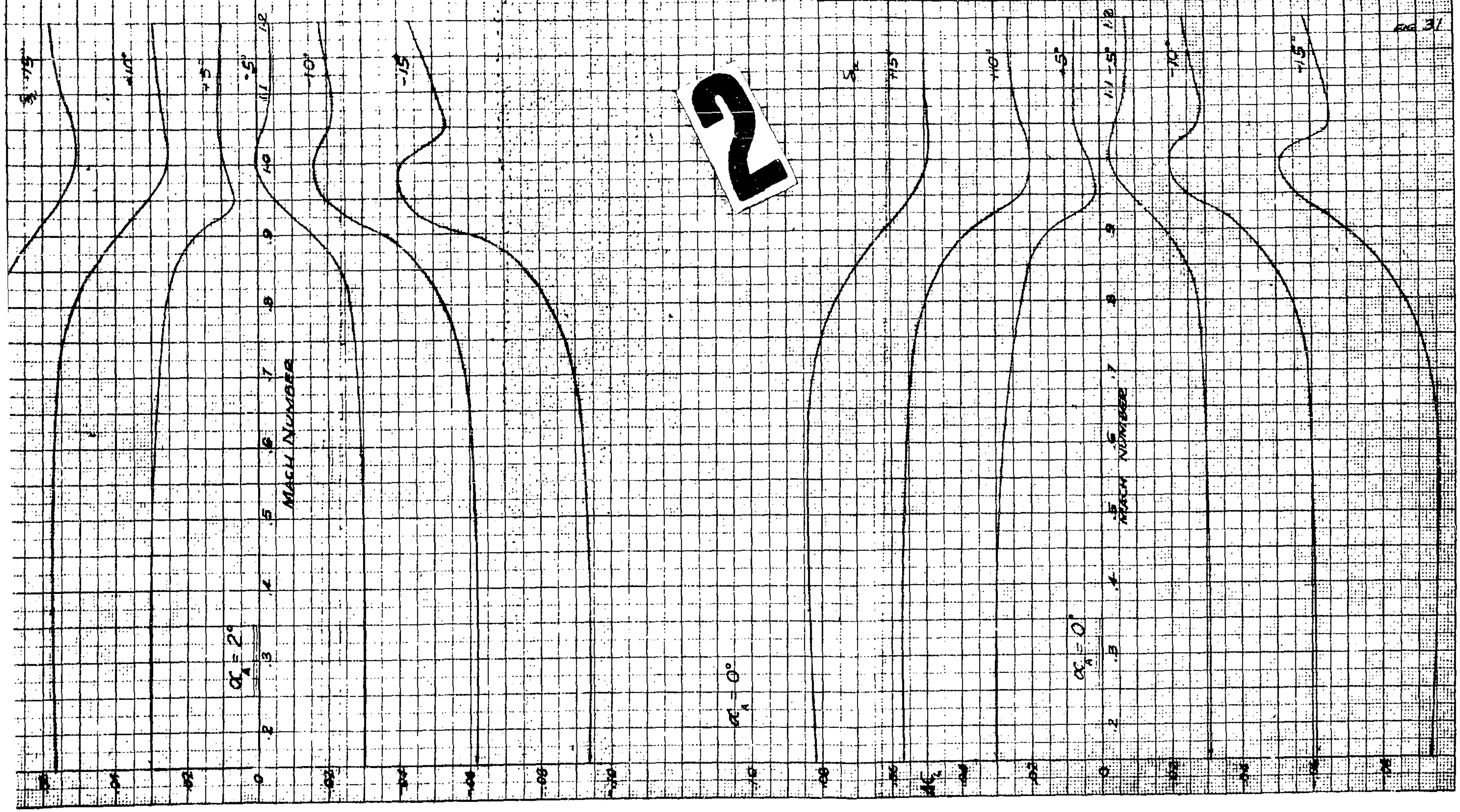
$\alpha_A = 0°$ & $\alpha_A = 2°$



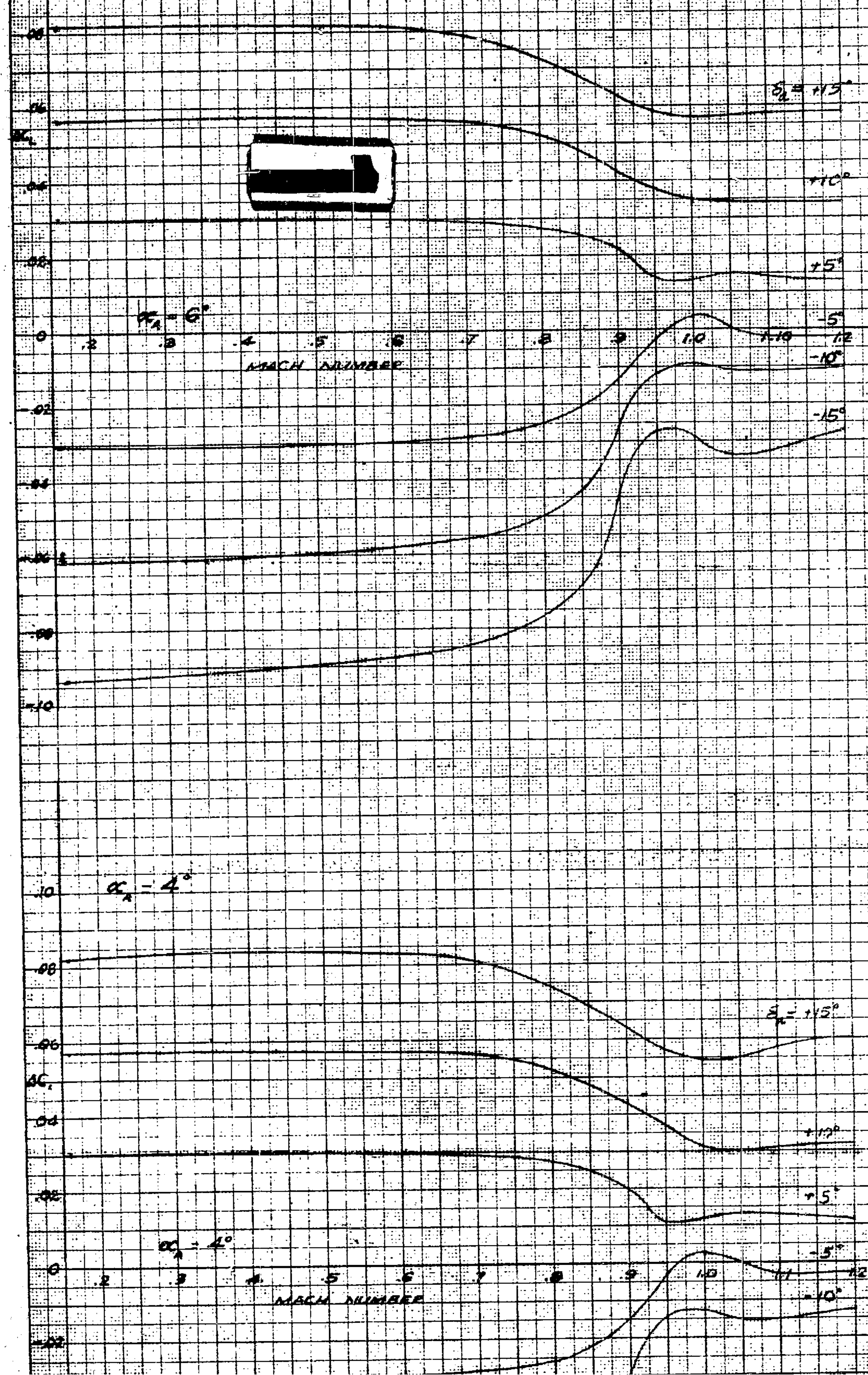
NORTH AME
ESTIMATED AERO
PREPARED BY HTO & GP
CHECKED BY [illegible]
DATE 9-5-49

PREPARED BY HTO & GP	NORTH AMERICAN AVIATION, INC.	PAGE NO 53 OF 81	
CHECKED BY WES		REPORT NO NA-50-1277	
DATE 9-5-49	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO F-86E	

FIG 31



ESTIMATED INCREMENT OF LIFT COEFFICIENT
DUE TO AILERON DEFLECTION
(ONE AILERON)
$\alpha_A = 4°$ & $\alpha_A = 6°$

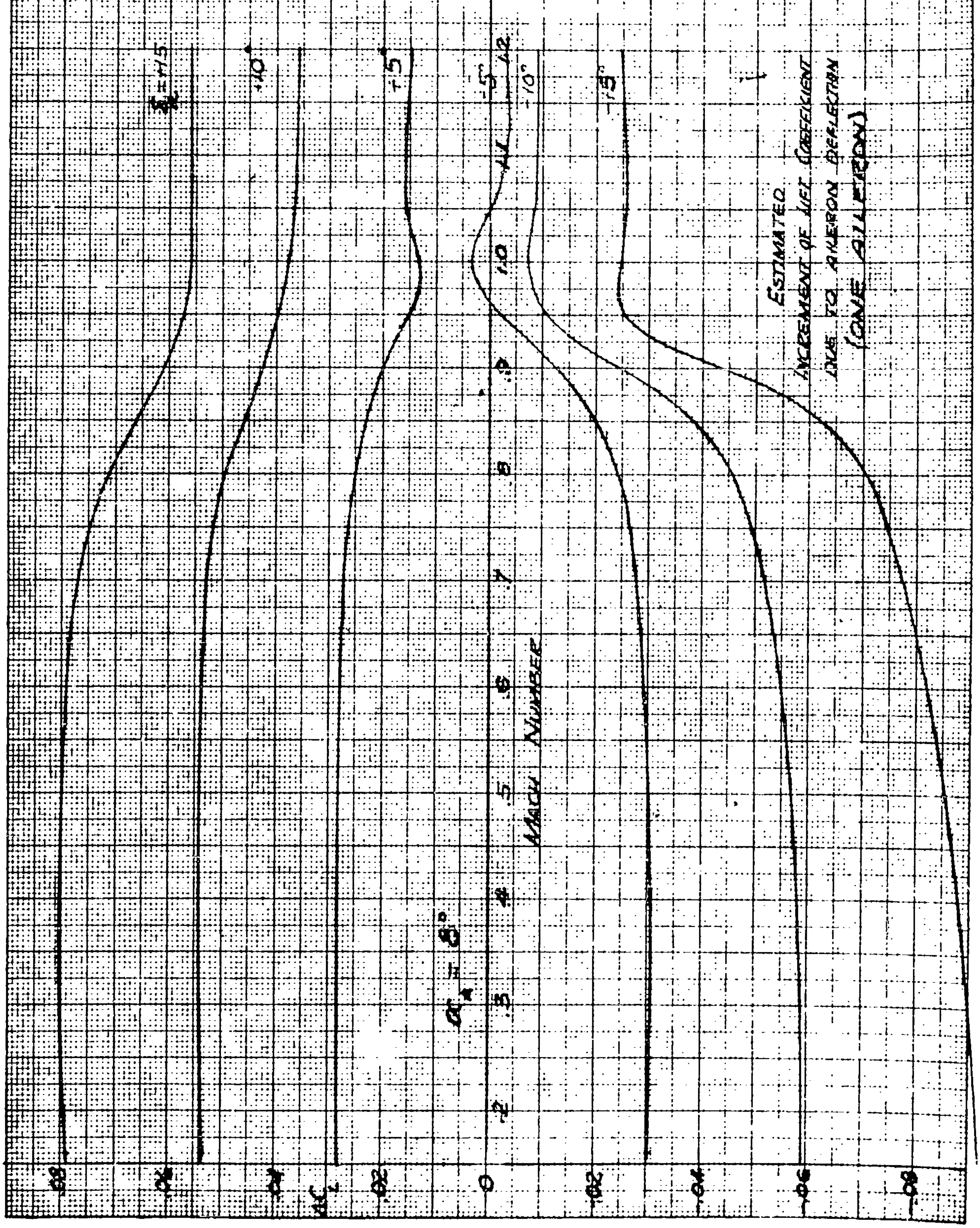


NORTH AMER[illegible]
ESTIMATED AER[illegible]
PREPARED BY HTO & GP
CHECKED BY WES
DATE 9-15-49

PREPARED BY HTD & GP	NORTH AMERICAN AVIATION, INC.		PAGE NO 54 OF 82
CHECKED BY NES			REPORT NO NA-50-4277
DATE 9-15-49	ESTIMATED AERODYNAMIC CHARACTERISTICS		MODEL NO F-86E

PREPARED BY: HTD & GP	NORTH AMERICAN AVIATION, INC.	PAGE NO 55 OF 8?
CHECKED BY: WES		REPORT NO NA-50-1277
DATE: 9-15-49	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO F-86E

FIG. 33



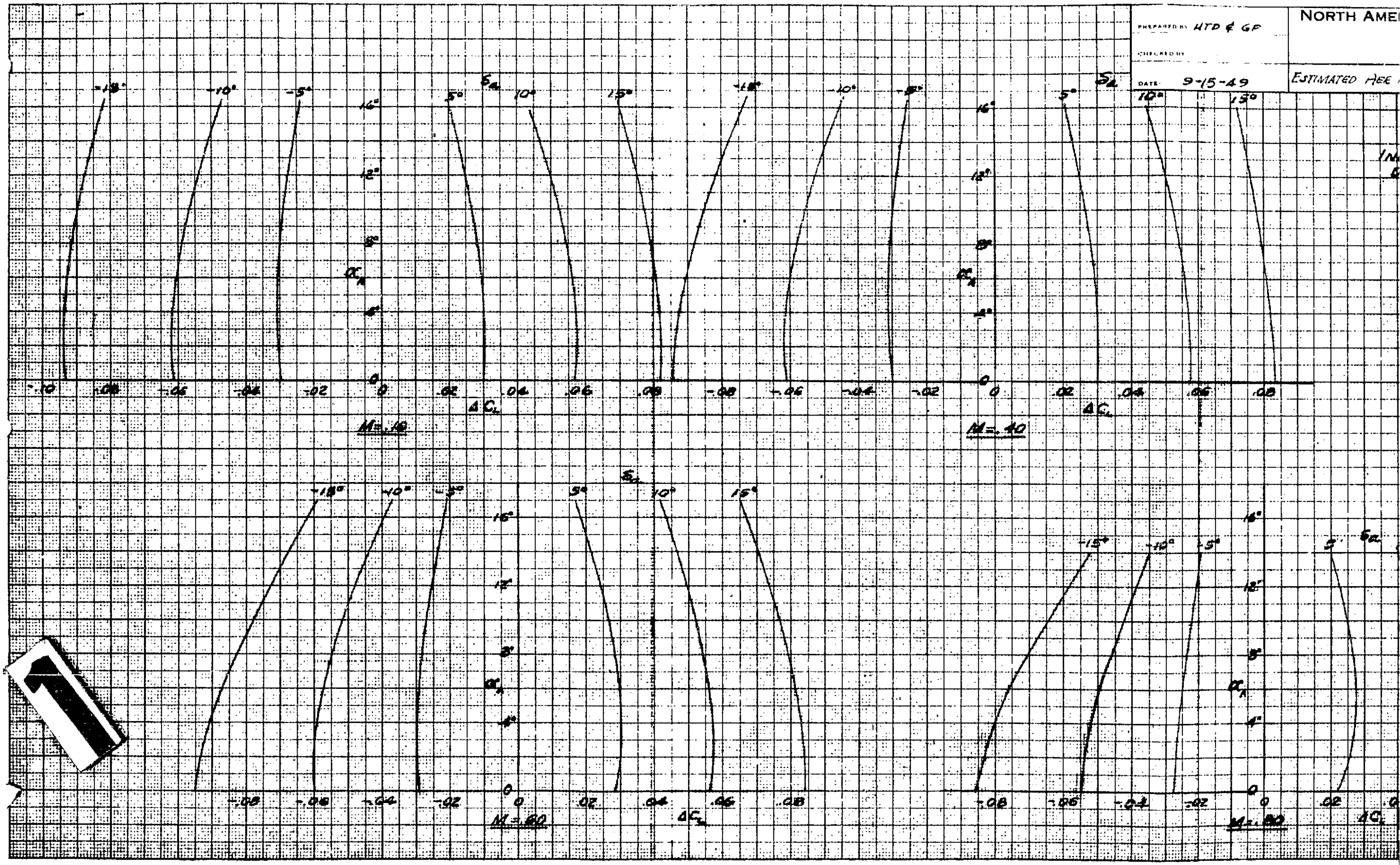
NORTH AME[...]

PREPARED BY HTD & GF

CHECKED BY

DATE 9-15-49

ESTIMATED HEE [...]



PREPARED BY HTD & GP	NORTH AMERICAN AVIATION, INC.		PAGE NO. 56 OF 82
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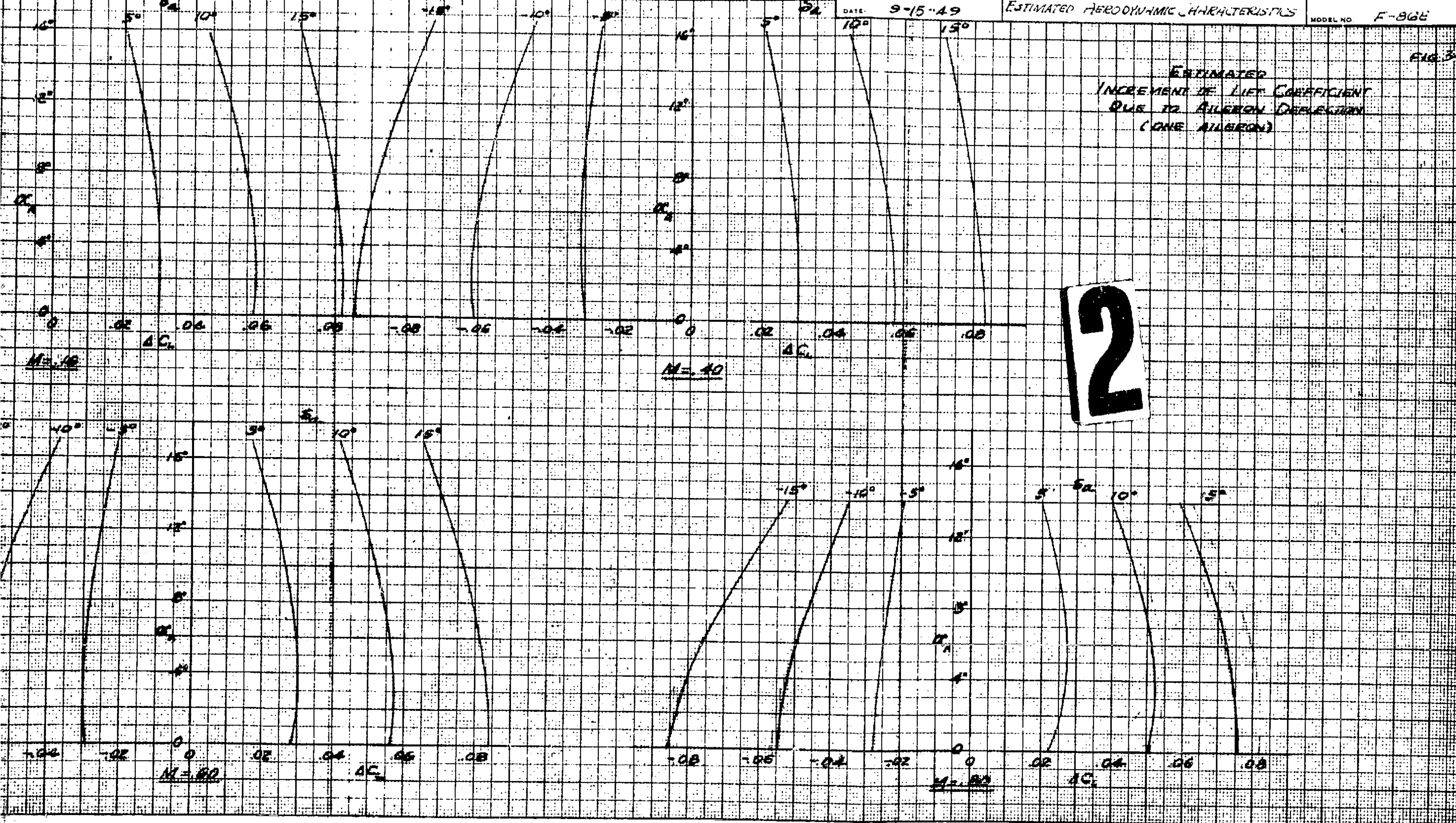
DATE: 9-15-49	ESTIMATED AERODYNAMIC CHARACTERISTICS		MODEL NO. F-86E

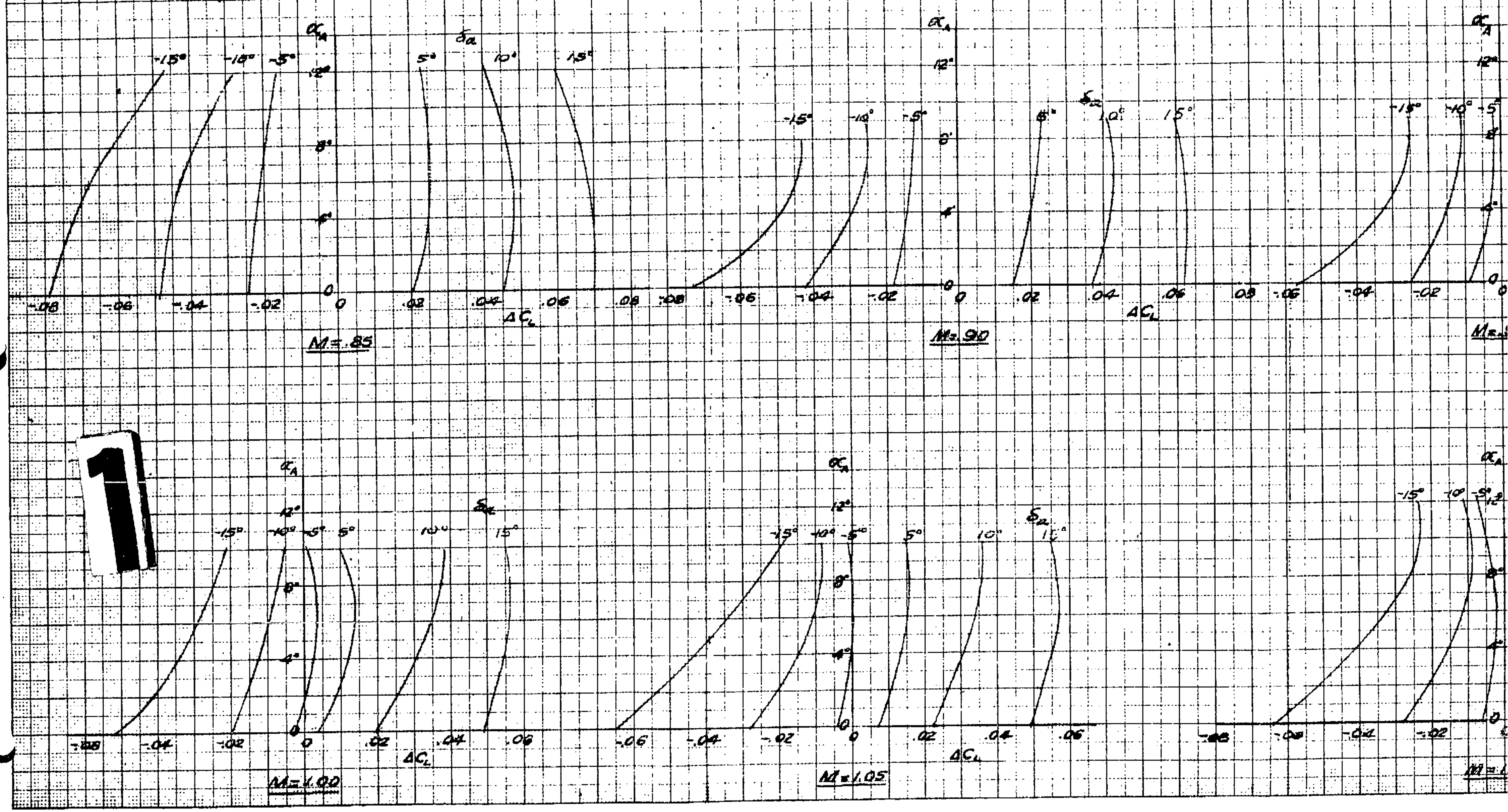
FIG. 34

ESTIMATED
INCREMENT OF LIFT COEFFICIENT
DUE TO AILERON DEFLECTION
(ONE AILERON)



PREPARED BY HTD & GP	NORTH AMER
CHECKED BY	
DATE 9-15-49	ESTIMATED AERO

ESTIMATED INCREMENT OF LIFT COEFFICIENT
DUE TO AILERON DEFLECTION
(ONE AILERON)



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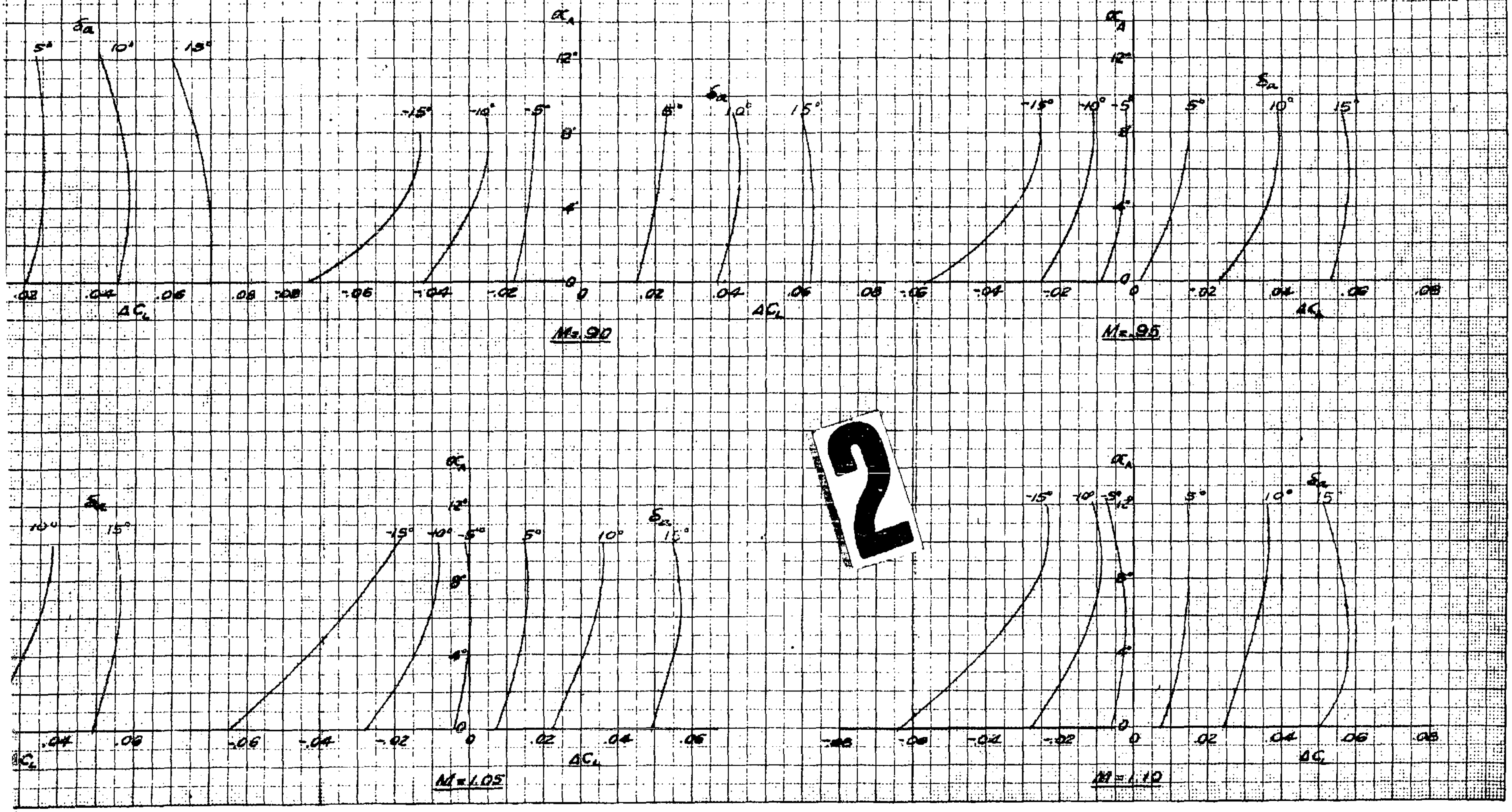
FORM ED-314 REV. 1-48

ESTIMATED INCREMENT OF LIFT COEFFICIENT
DUE TO AILERON DEFLECTION
(ONE AILERON)

FIG. 35



PREPARED BY HTO & GP	NORTH AMERICAN AVIATION, INC.	PAGE NO. 58 OF 82
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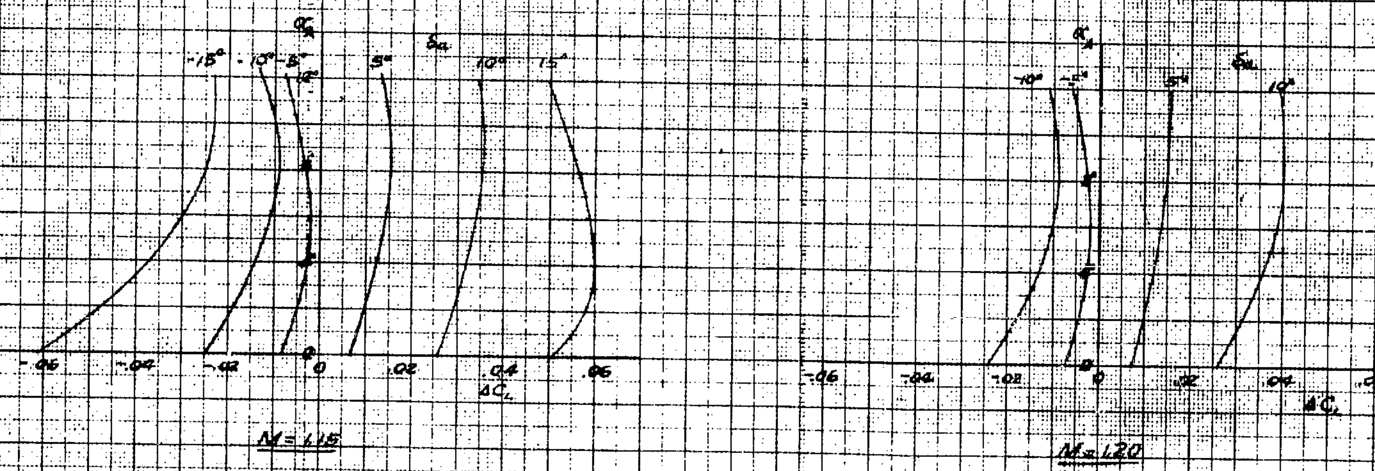
DATE 9·16·49	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO. F-86E

FIG. 36

ESTIMATED
INCREMENT OF LIFT COEFFICIENT
DUE TO AILERON DEFLECTION
(ONE AILERON)



PREPARED BY HTO & GP	NORTH AMERICAN AVIATION, INC.	PAGE NO 59 OF 82	FORM 20-214
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DATE: 9-16-49	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO F-86E	

INCREMENT OF ROLLING MOMENT DUE TO AILERON DEFLECTION
(LEFT AILERON)

FIG 37

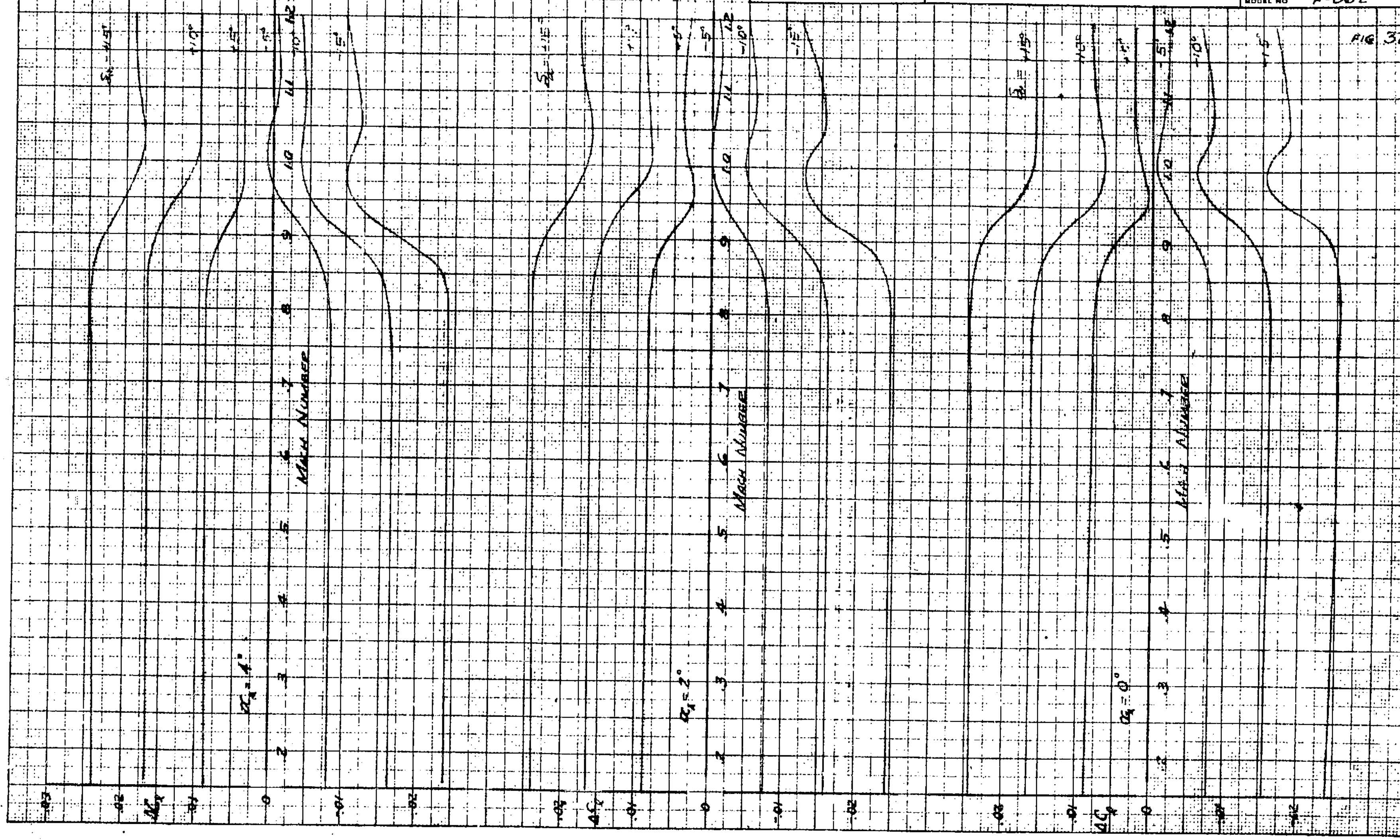
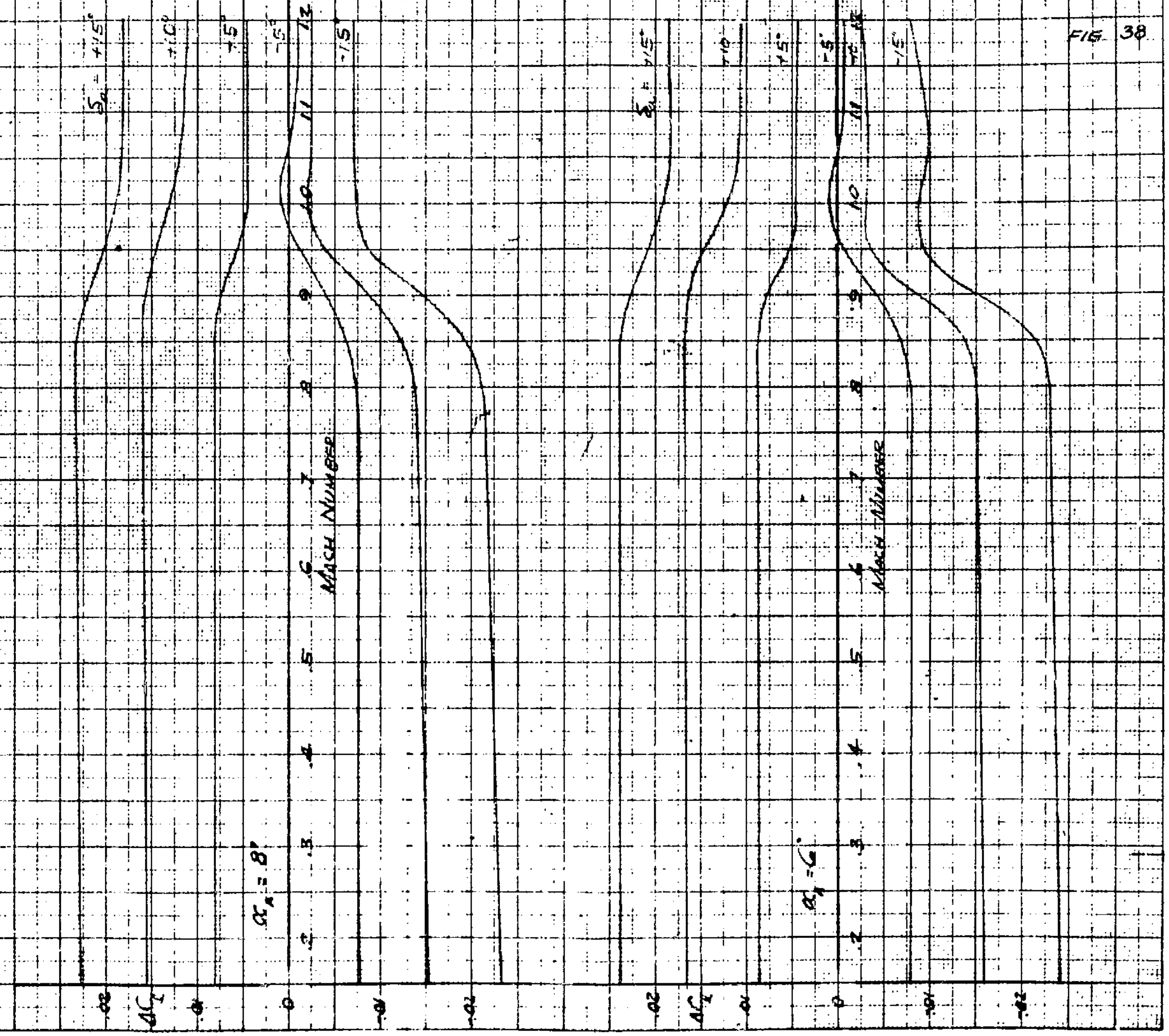
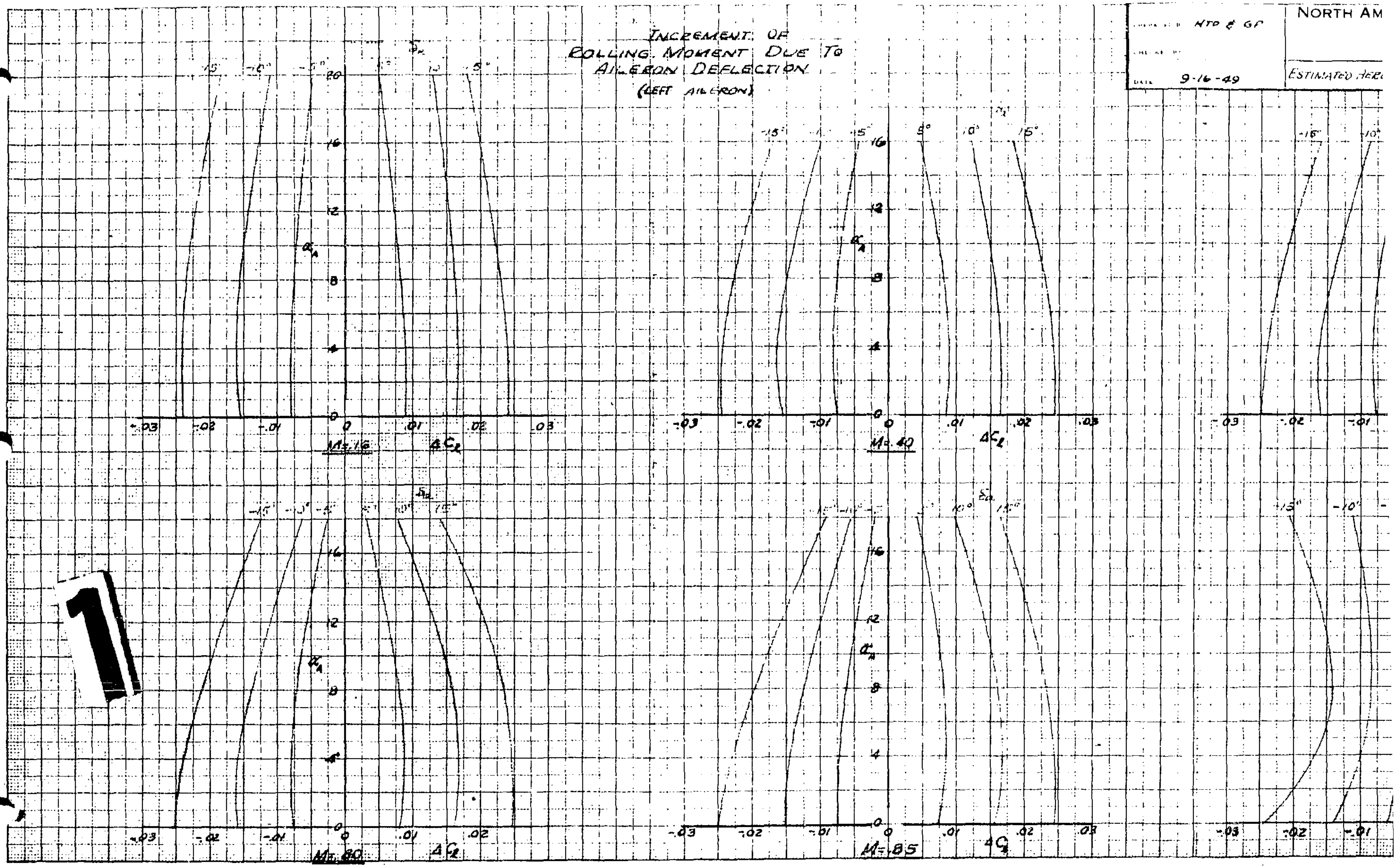


FIG. 38



INCREMENT OF
ROLLING MOMENT DUE TO
AILERON DEFLECTION
(LEFT AILERON)

Increment of Rolling Moment Due To Aileron Deflection (Left Aileron)



Calculated by: HTO & GP	NORTH AMERICAN AVIATION, INC.	Page No. 61 of 82
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Date: 9-16-49	ESTIMATED AERODYNAMIC CHARACTERISTICS	Model No. F-86E

INCREMENT OF ROLLING MOMENT DUE TO AILERON DEFLECTION

(LEFT AILERON)

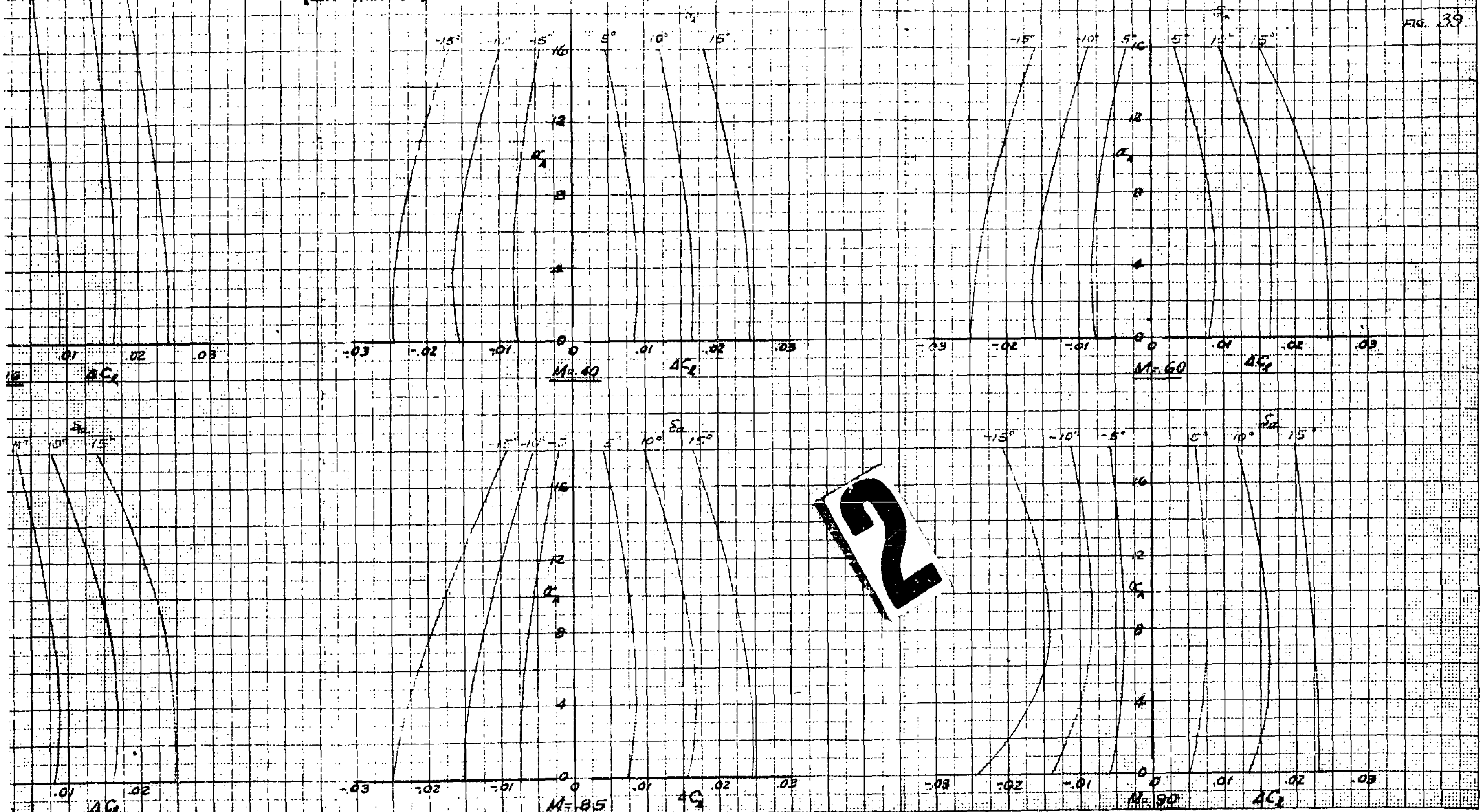

FIG. 39

FORM ED 314

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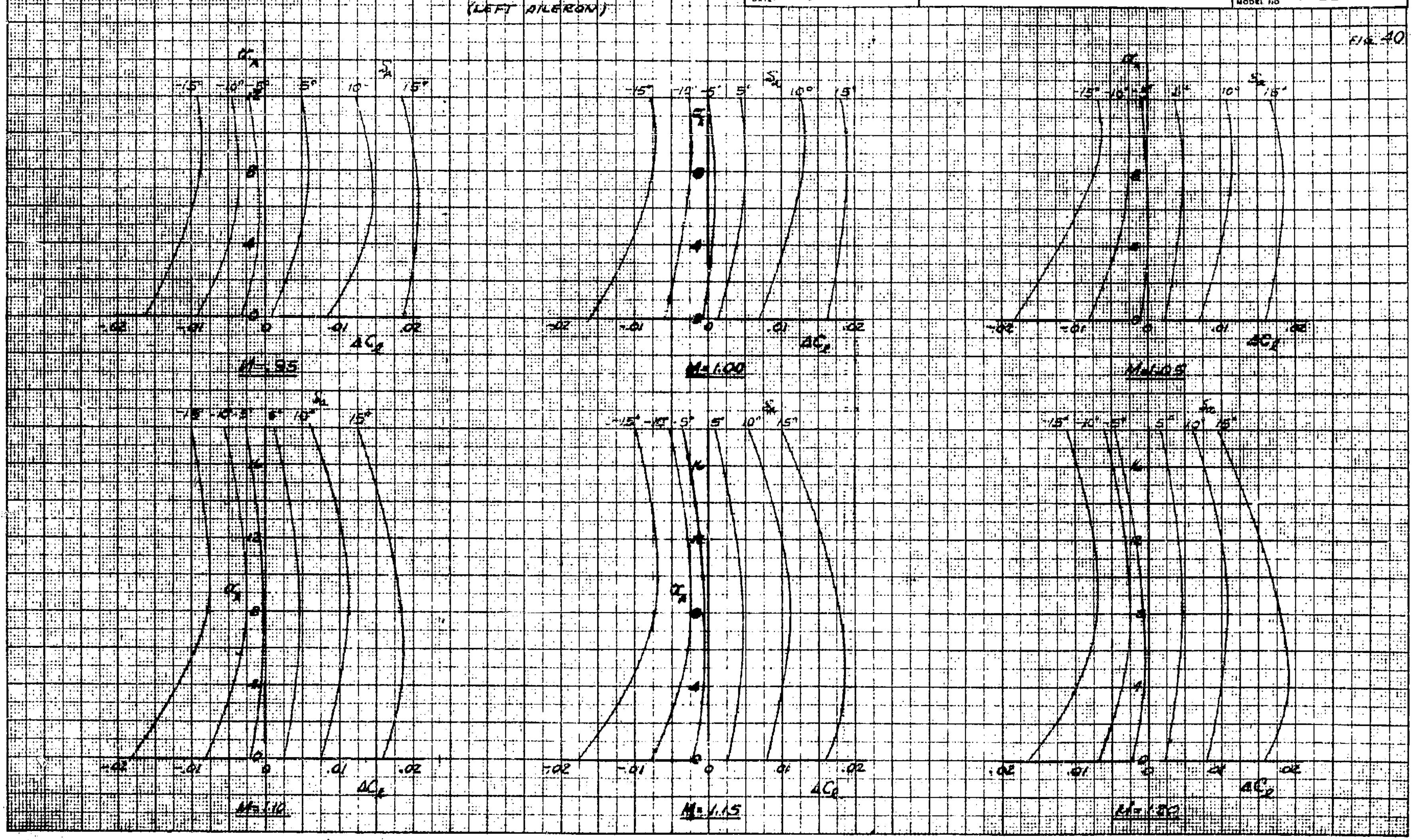
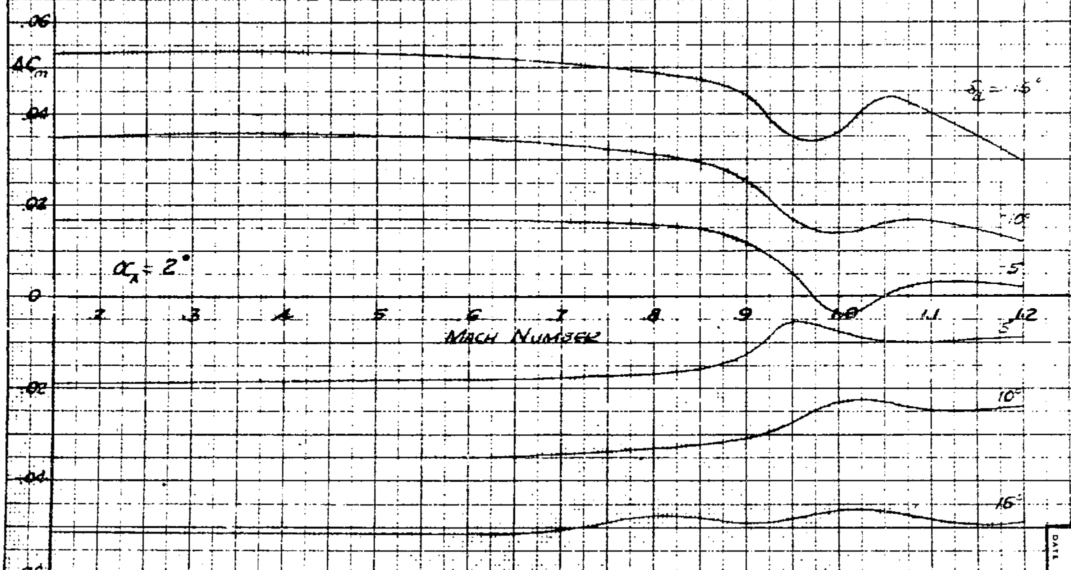
DATE 9-16-49	ESTIMATED AERODYNAMICS CHARACTERISTICS	MODEL NO. F-86E

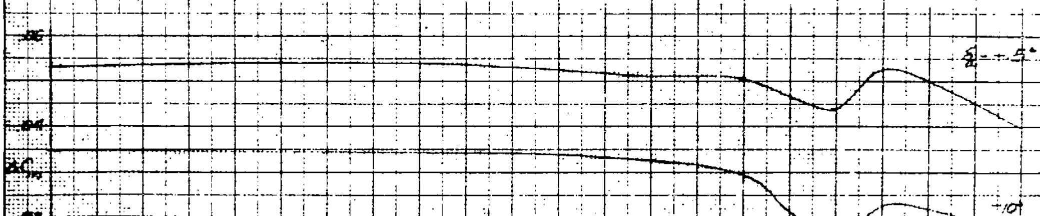
INCREMENT OF ROLLING MOMENT DUE TO AILERON DEFLECTION

(LEFT AILERON)



INCREMENT OF
PITCHING MOMENT DUE TO
AILERON DEFLECTION
(ONE AILERON)





PREPARED BY HTO & GP
CHECKED BY
DATE 9-14-49

NORTH AME
ESTIMATED AERO

PREPARED BY HTD & GP	NORTH AMERICAN AVIATION, INC.	PAGE NO.
CHECKED BY		REPORT NO. NA 50
DATE 9-14-49	ESTIMATED AERODYNAMICS CHARACTERISTICS	MODEL NO. F-86

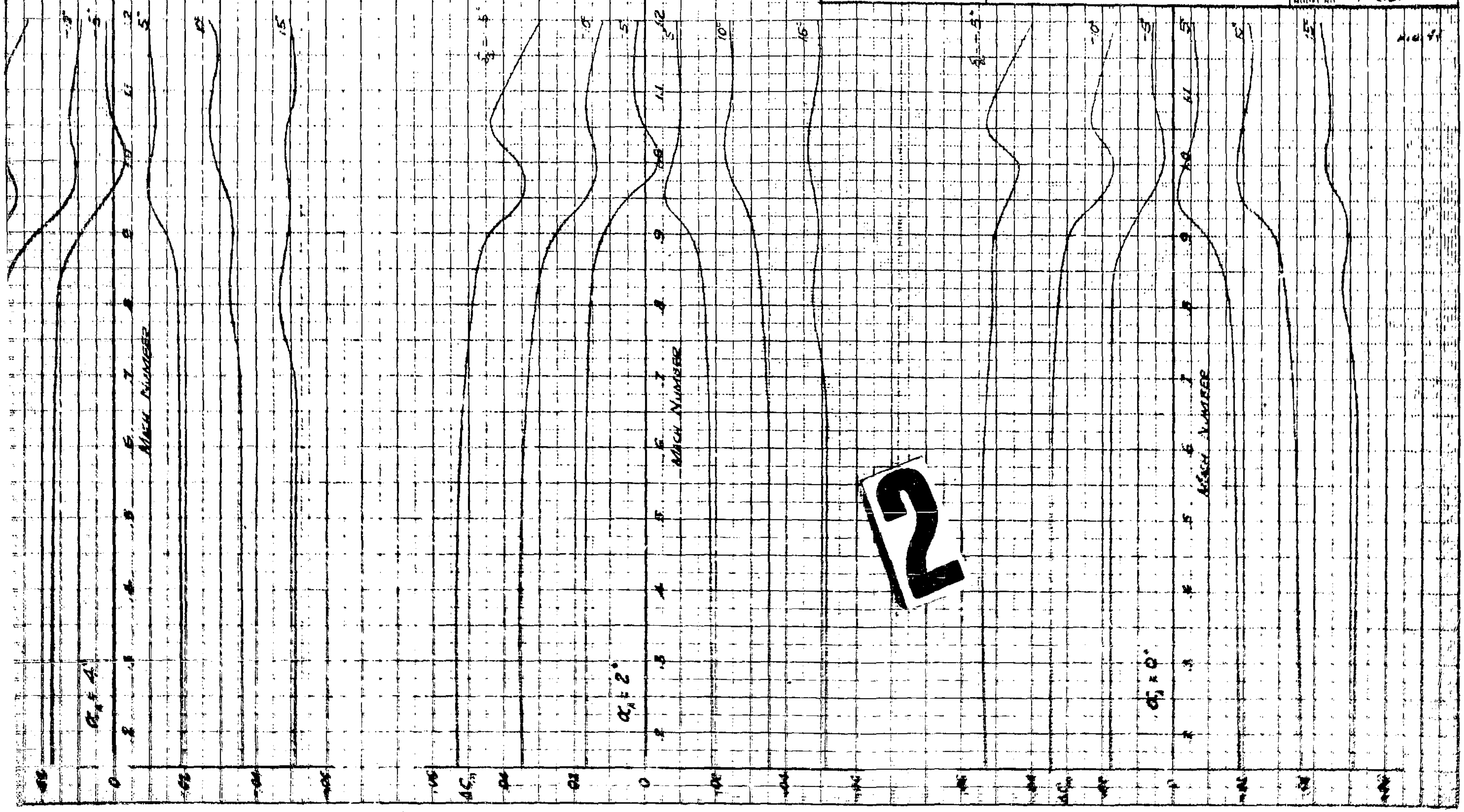
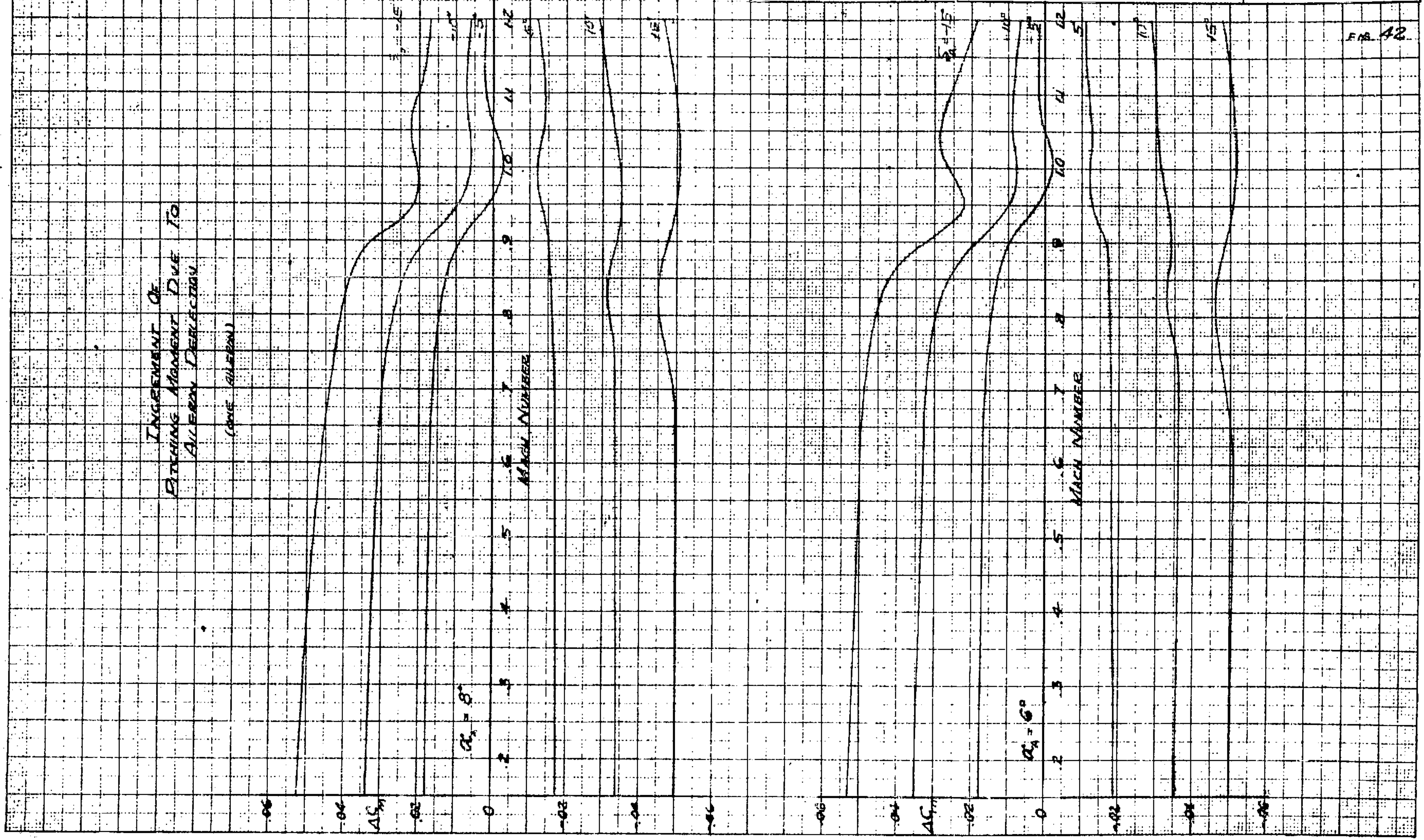


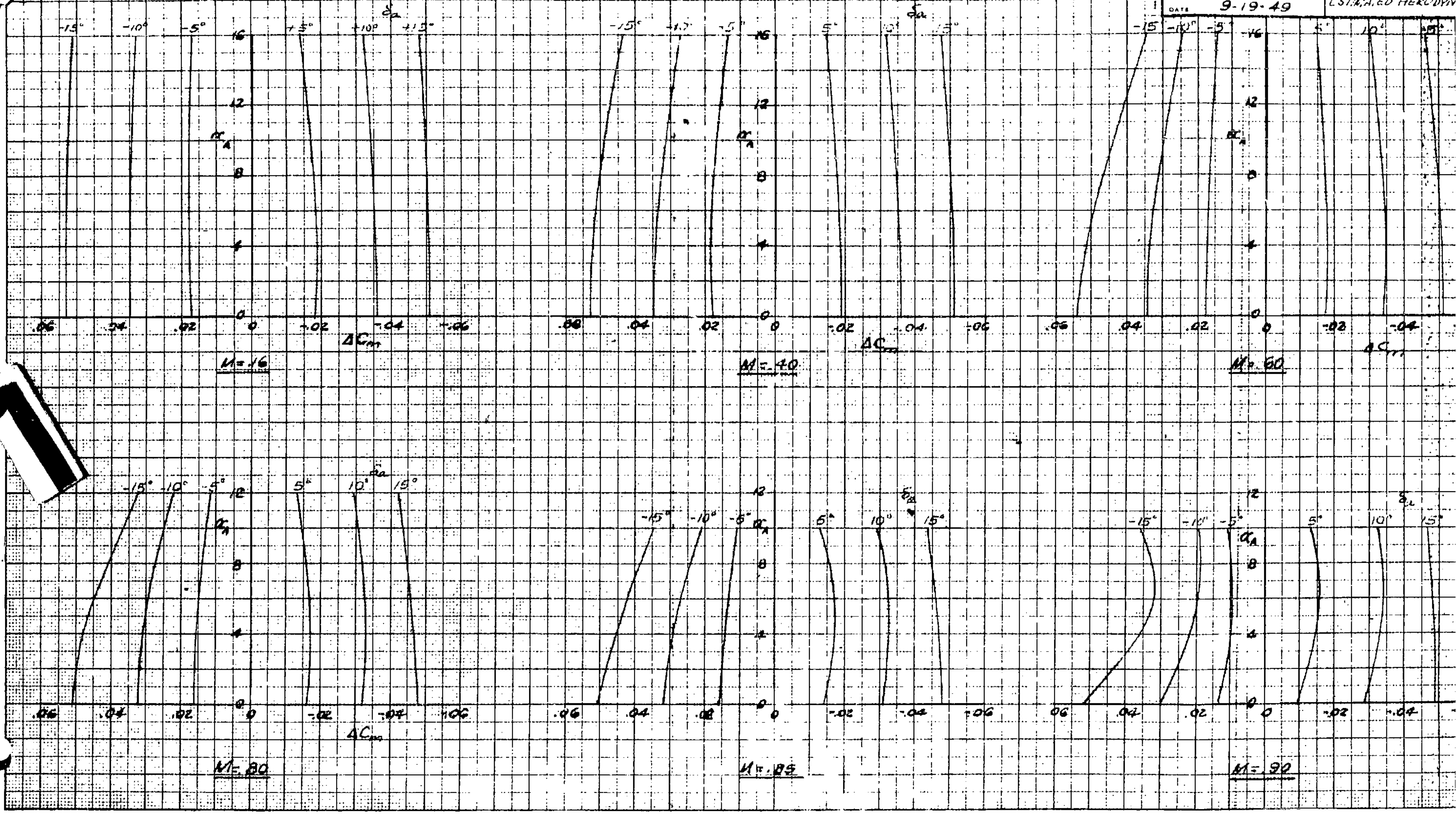
FIG. 42


INCREMENT OF
PITCHING MOMENT DUE TO
AILERON DEFLECTION
(ONE AILERON)
$\alpha_A = 8°$
$\alpha_A = 6°$
MACH NUMBER
MACH NUMBER
ΔC_m
ΔC_m

PREPARED BY HTD & G.P | CHECKED BY | DATE 9-19-49

NORTH AMERIC

ESTIMATED AERODYN



PREPARED BY HTD & G.P	NORTH AMERICAN AVIATION, INC.		PAGE NO 65 OF 82
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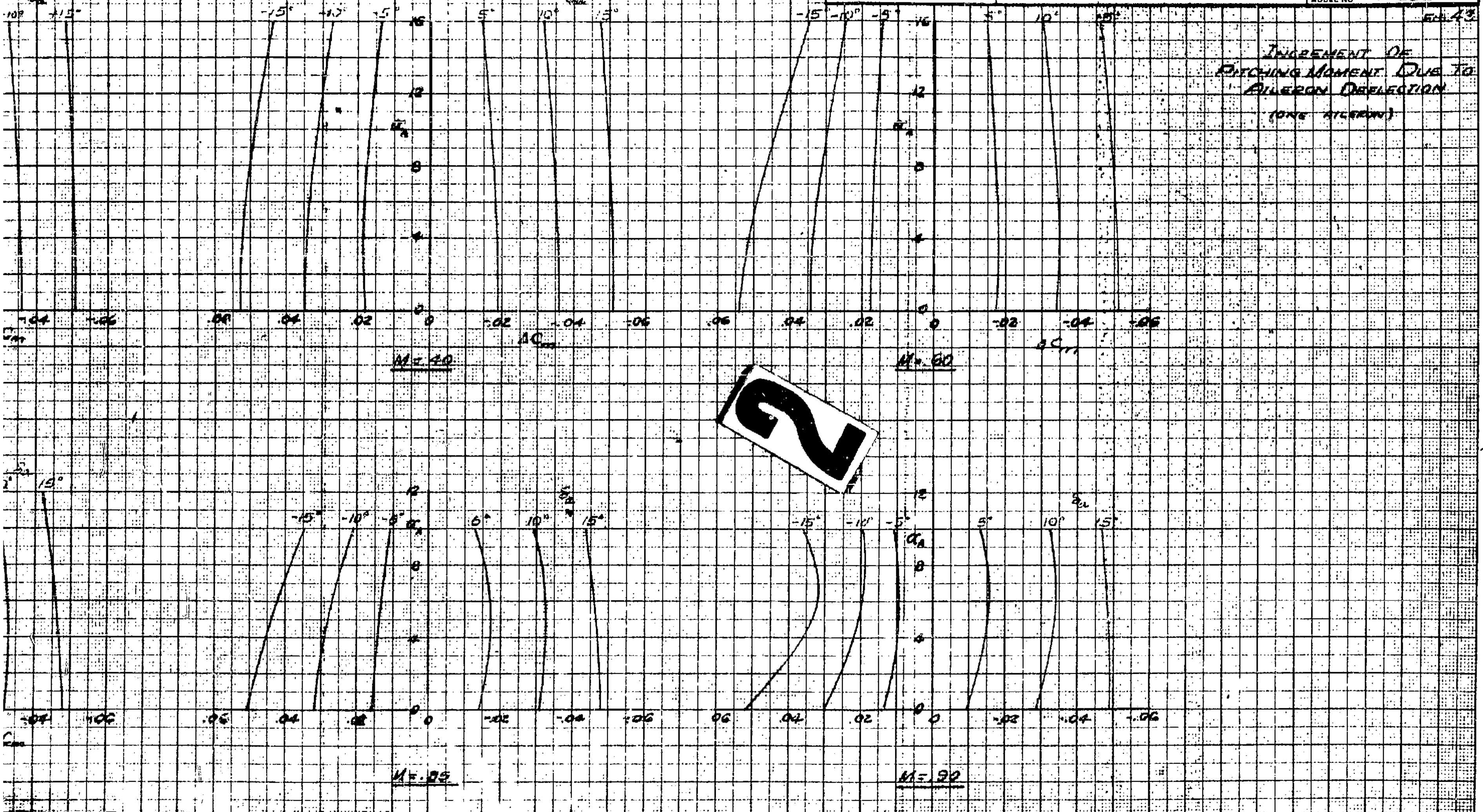
DATE 9-19-49	ESTIMATED AERODYNAMIC CHARACTERISTICS		MODEL NO F-86E

FIG. 43

INCREMENT OF PITCHING MOMENT DUE TO AILERON DEFLECTION

(ONE AILERON)

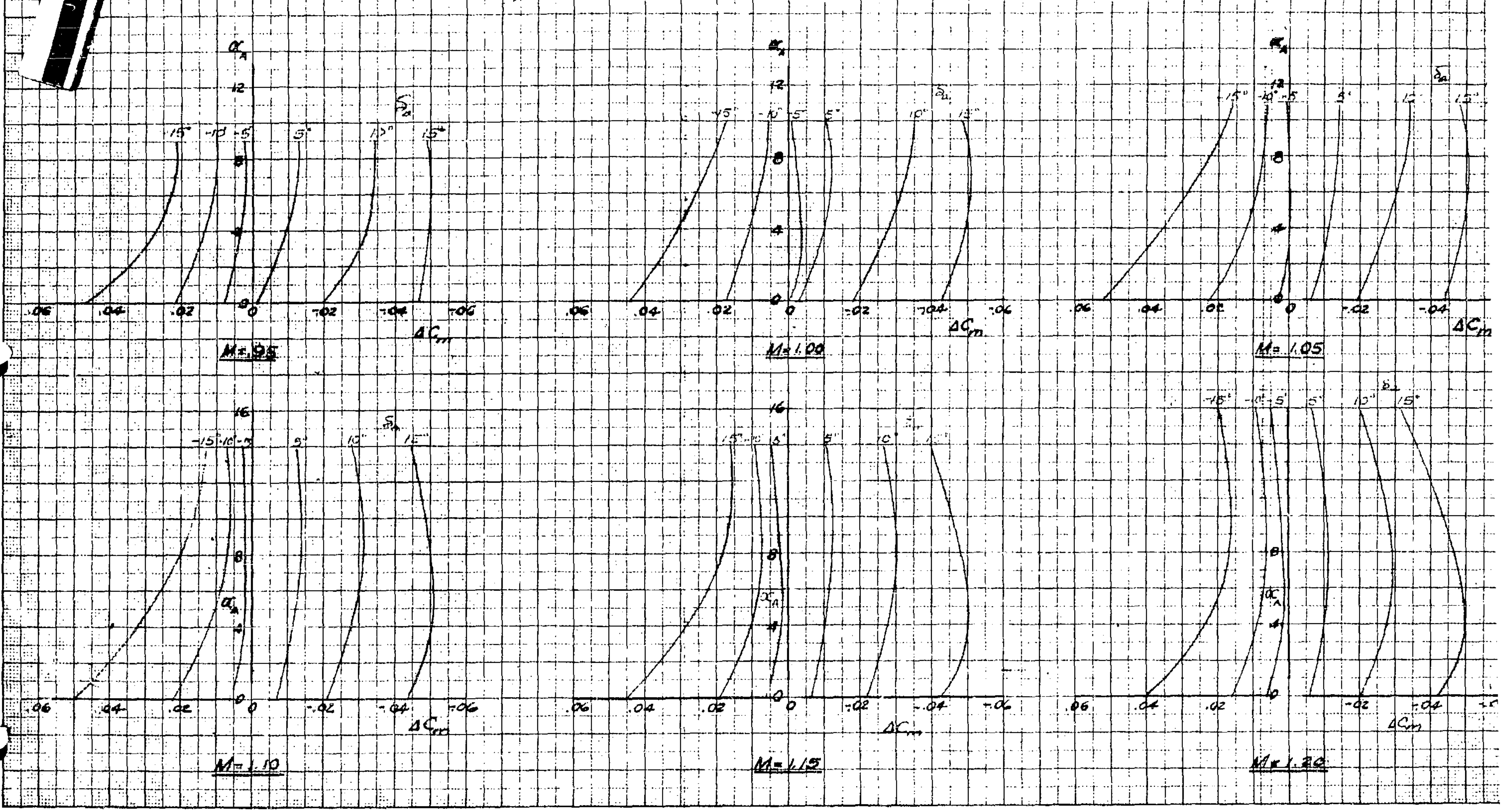


FORM ED-324 REV. 1-48

PREPARED BY HTD & GP
CHECKED BY
DATE 9-19-49

NORTH AMERI

ESTIMATED AERODY



PREPARED BY HTD & GD	NORTH AMERICAN AVIATION, INC.	PAGE NO. 66 OF 86	
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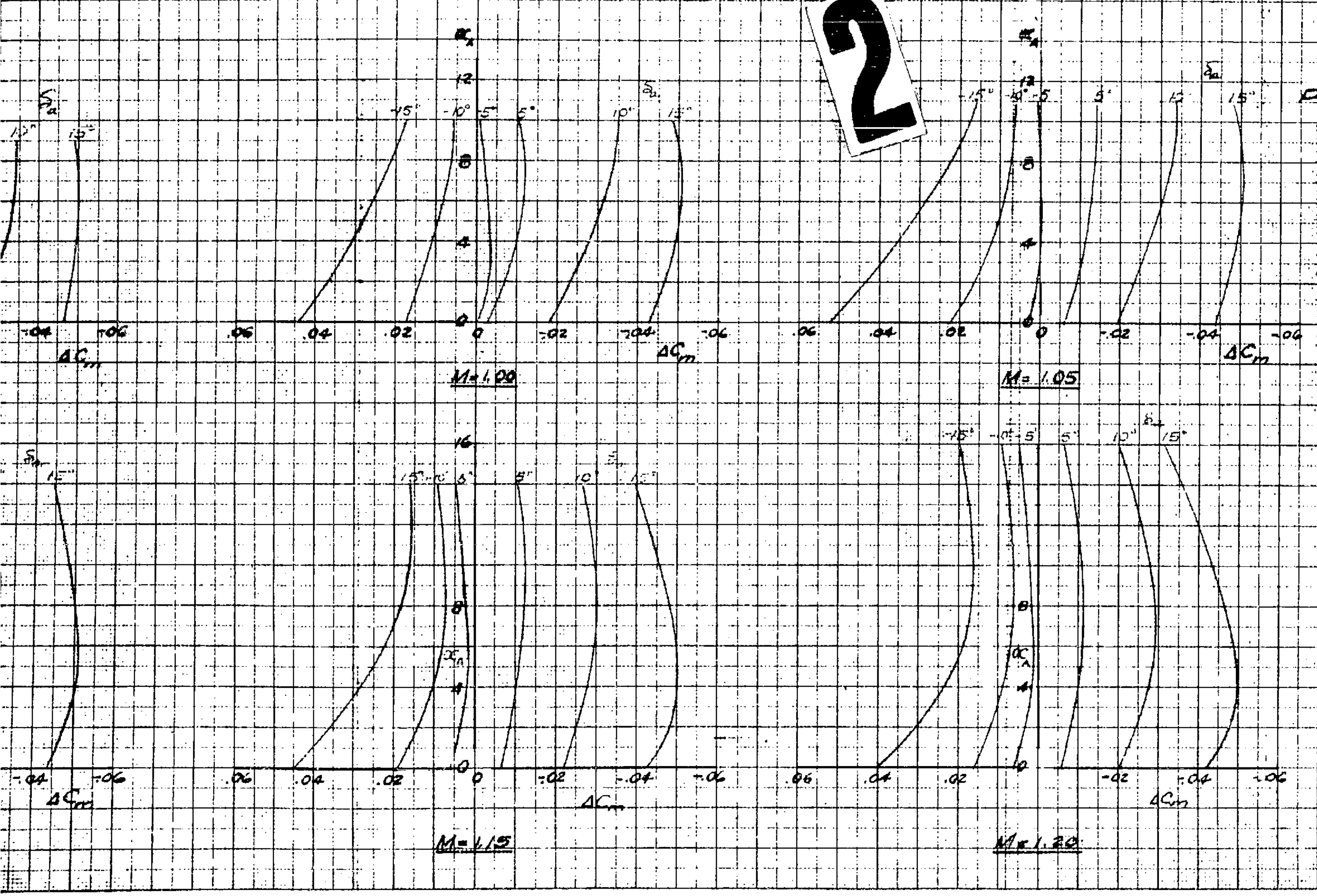
FIG. 44

INCREMENT OF PITCHING MOMENT DUE TO AILERON DEFLECTION

(ONE AILERON)



PREPARED BY	RPP
CHECKED BY	GP
DATE	1-20-49

NORTH AMERIC

ESTIMATED AERODYNAMI

ESTIMATED S

HINGE MOMEN

BASED ON FLIGHT 19

REPORTS 52 & 130,

SLAT TRANSITION, δ_a =

c_a/c_w = .2732, c_b/c

— — ABRUPT STALL

——— GRADUAL STALL

NOTE: THESE DATA APPLY TO YF-93A, F-86D, AND TO THOSE F-86A AIRPLANES HAVING SHORT CHORD AILERONS.

$\delta_a = 0°$

FIG. 45

ESTIMATED SHORT CHORD AILERON HINGE MOMENT COEFFICIENTS

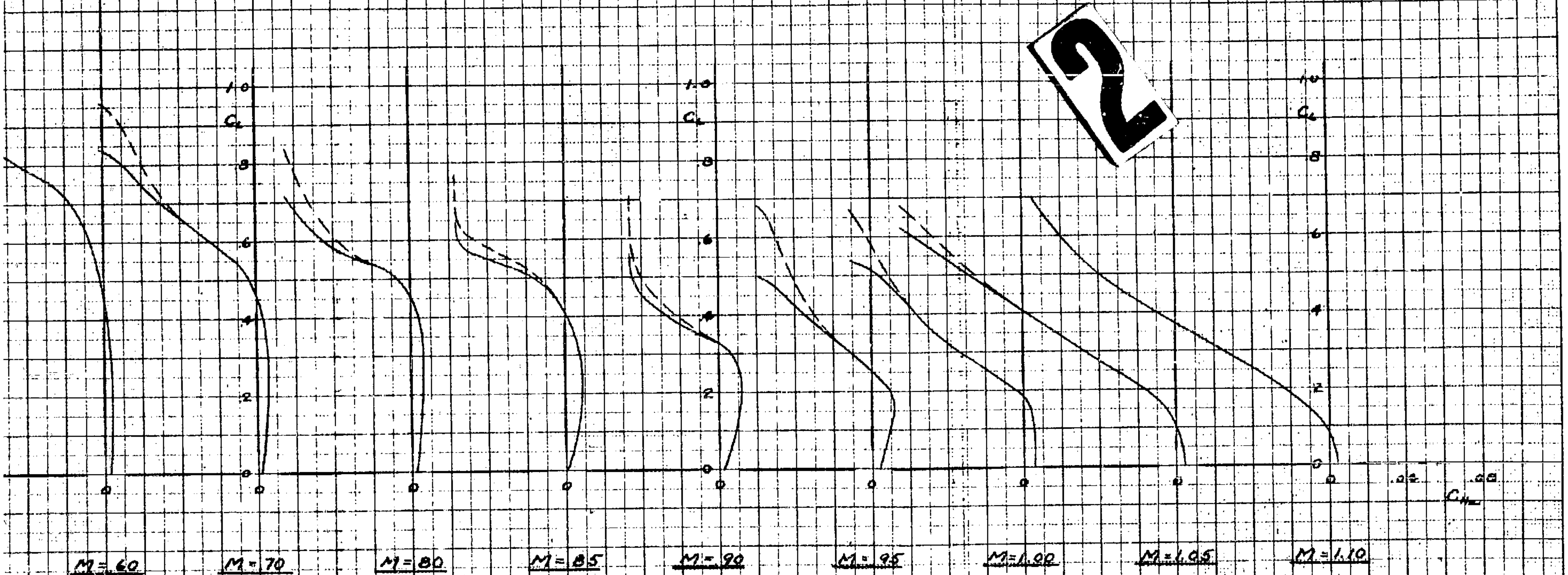
BASED ON FLIGHT 19 OF F-86A # 49-1067, CWT REPORTS 52 & 130, AND NRAL 142

SLAT TRANSITION, $\delta_a = 0°$, GRADUAL AND ABRUPT STALL
$c_a/c_w = .2732$, $c_b/c_a = .4390$, $S_a \bar{c}_a = 26.49$ FT³

——— ABRUPT STALL
——— GRADUAL STALL

NOTE: THESE DATA APPLY TO YF-93A, F-86D, AND TO THOSE F-86A AIRPLANES HAVING SHORT CHORD AILERONS.

$\delta_a = 0°$



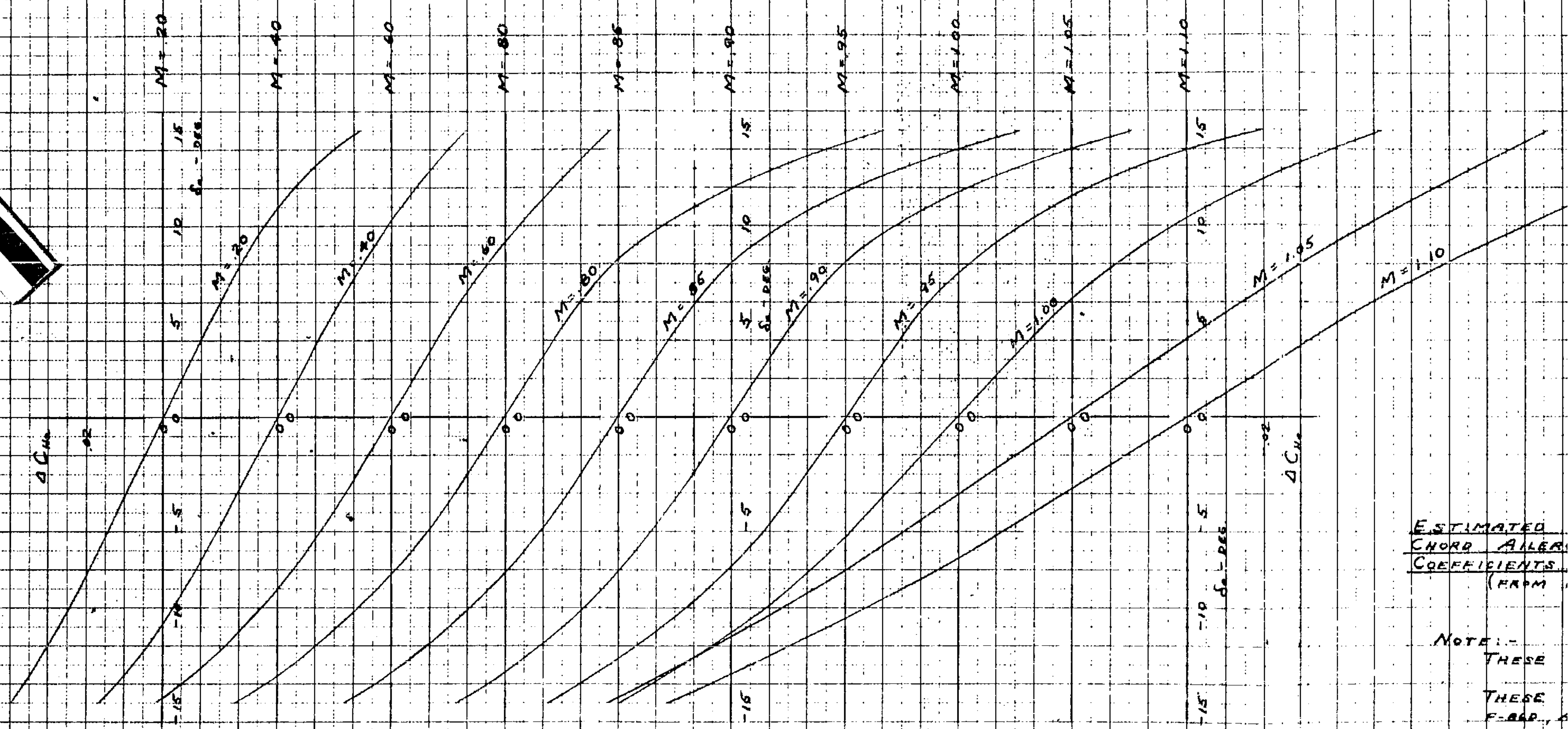
PREPARED BY RPP & GP

CHECKED BY

DATE 1-19-50

NORTH AMERICA[N]

ESTIMATED AERODYNAM[IC]



ESTIMATED ...
CHORD AILER...
COEFFICIENTS ...
(FROM ...

NOTE:-
THESE ...

THESE ...
F-86D, ...
HAVING ...

PREPARED BY RPP & GP	NORTH AMERICAN AVIATION, INC.		PAGE NO. 68 OF 88
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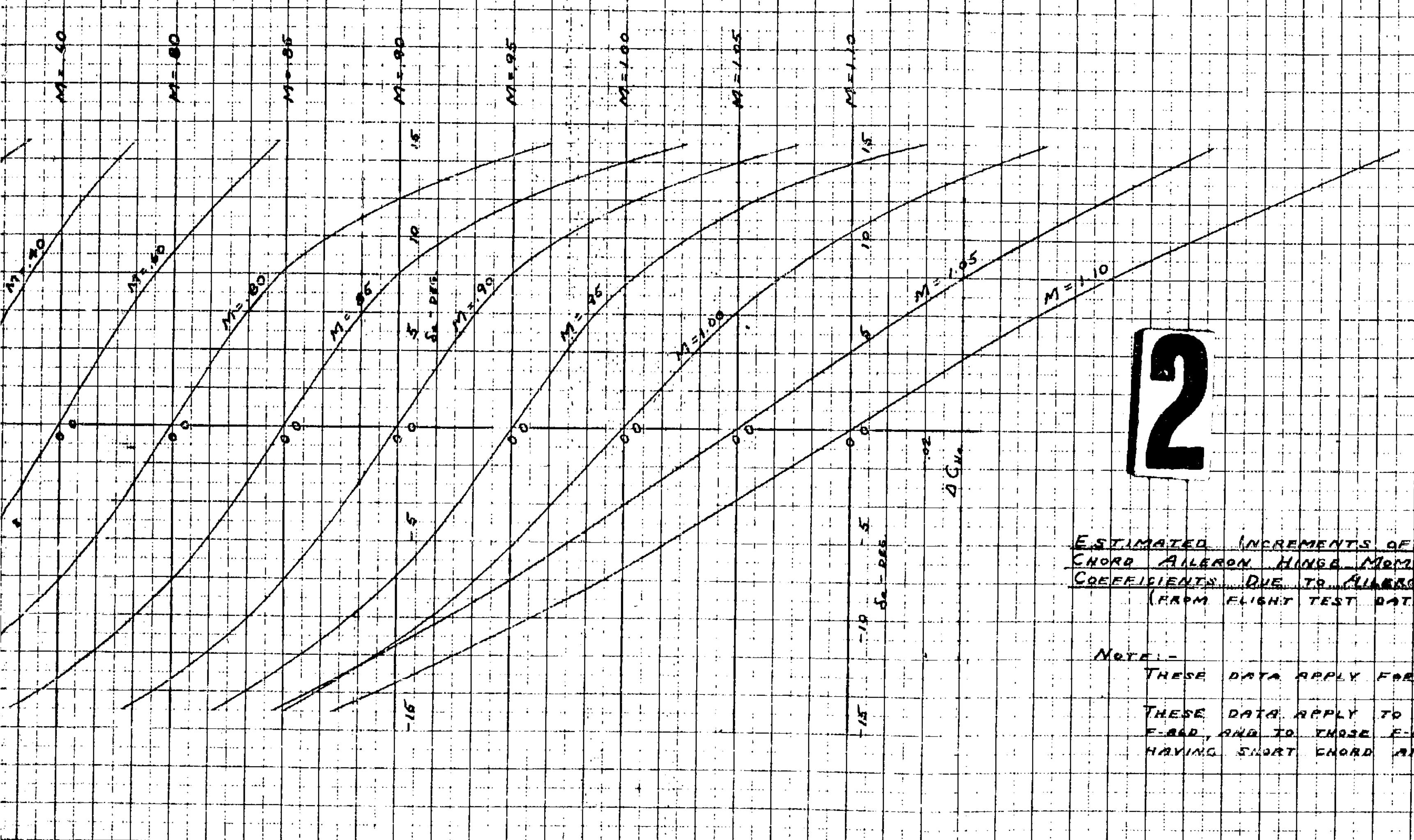
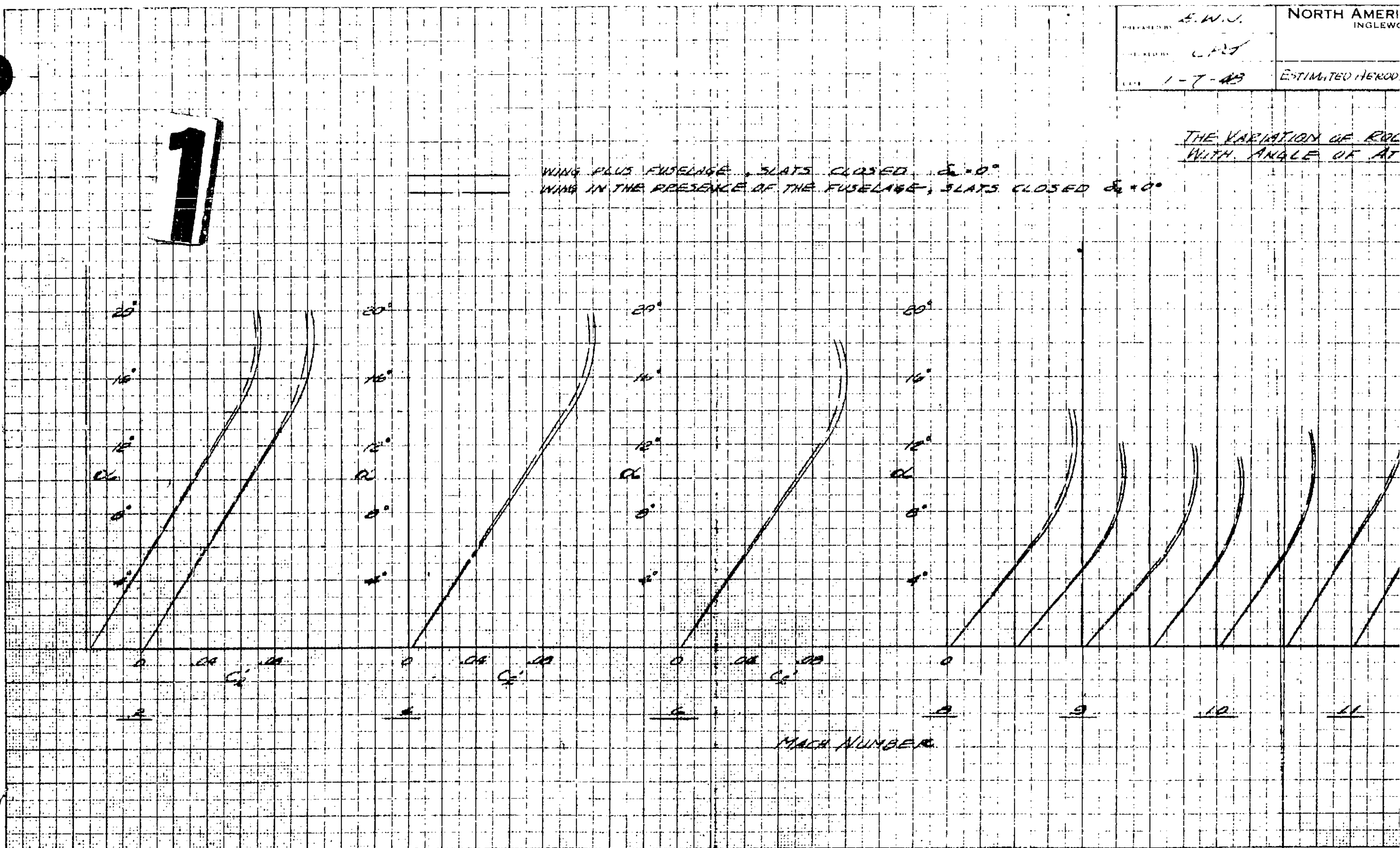
FIG. 46



ESTIMATED INCREMENTS OF SHORT CHORD AILERON HINGE MOMENT COEFFICIENTS DUE TO AILERON DEFLECTION
(FROM FLIGHT TEST DATA)

NOTE:-
THESE DATA APPLY FOR ALL C_L'S.

THESE DATA APPLY TO YF-93A, F-86D, AND TO THOSE F-86A AIRPLANES HAVING SHORT CHORD AILERONS.


PREPARED BY E.W.J.
CHECKED BY C.A.J.
DATE 1-7-43
NORTH AMERI
INGLEWO
ESTIMATED AERODY
THE VARIATION OF ROL
WITH ANGLE OF AT
WING PLUS FUSELAGE, SLATS CLOSED $\delta_a = 0°$
WING IN THE PRESENCE OF THE FUSELAGE, SLATS CLOSED $\delta_a = 0°$
20°
16°
12°
α
8°
4°
0
.04
.08
C_l'
.2
.4
.6
.8
.9
.10
.11
MACH NUMBER

PREPARED BY E.W.J.	NORTH AMERICAN AVIATION, INC. INGLEWOOD, CALIFORNIA	PAGE NO. 69 OF 86
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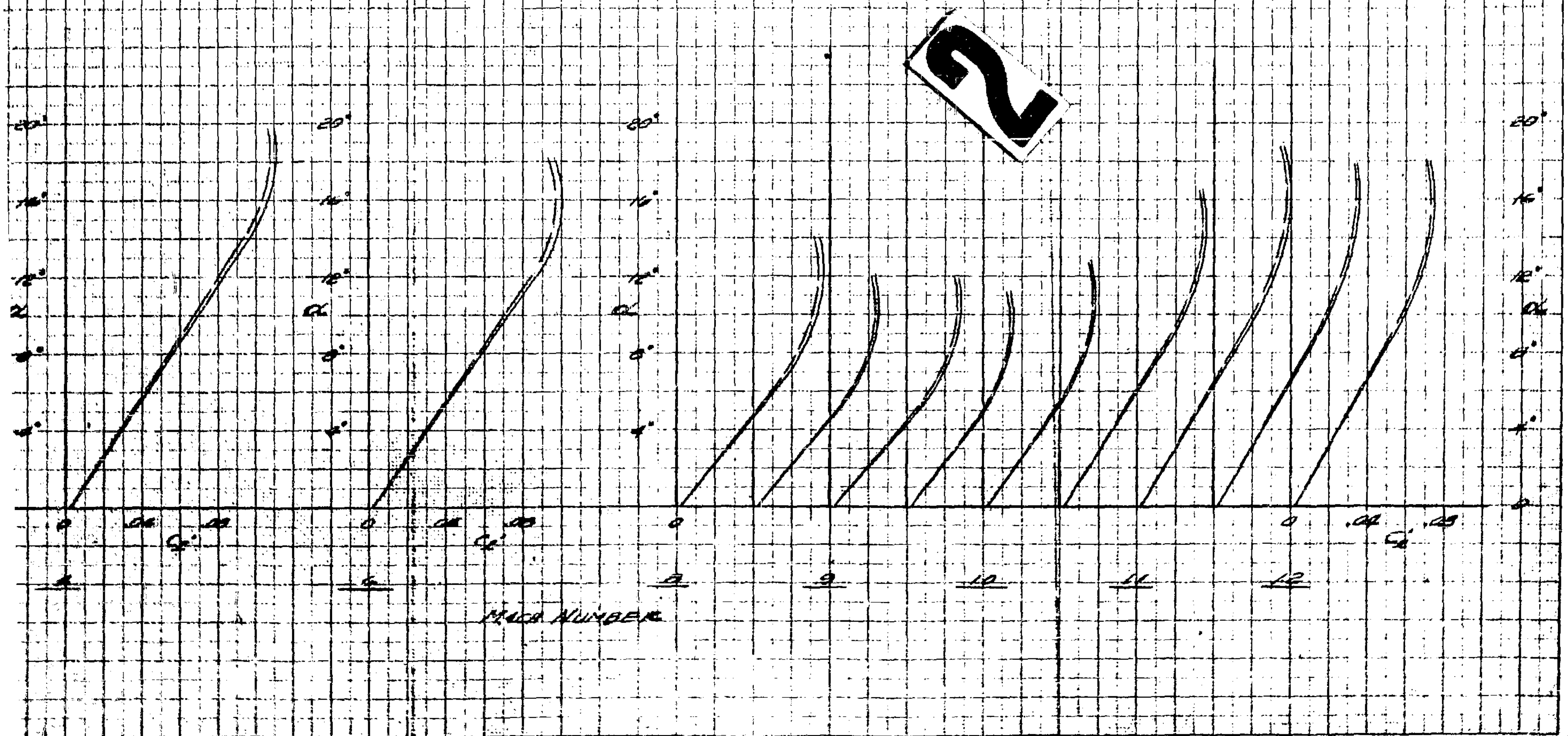
Fig. 47

THE VARIATION OF ROLLING MOMENT DUE TO LIFT WITH ANGLE OF ATTACK. (LIFT ON LEFT WING ONLY)

——— WING PLUS FUSELAGE, SLATS CLOSED $\delta_a = 0°$
— — WING IN THE PRESENCE OF THE FUSELAGE, SLATS CLOSED $\delta_a = 0°$

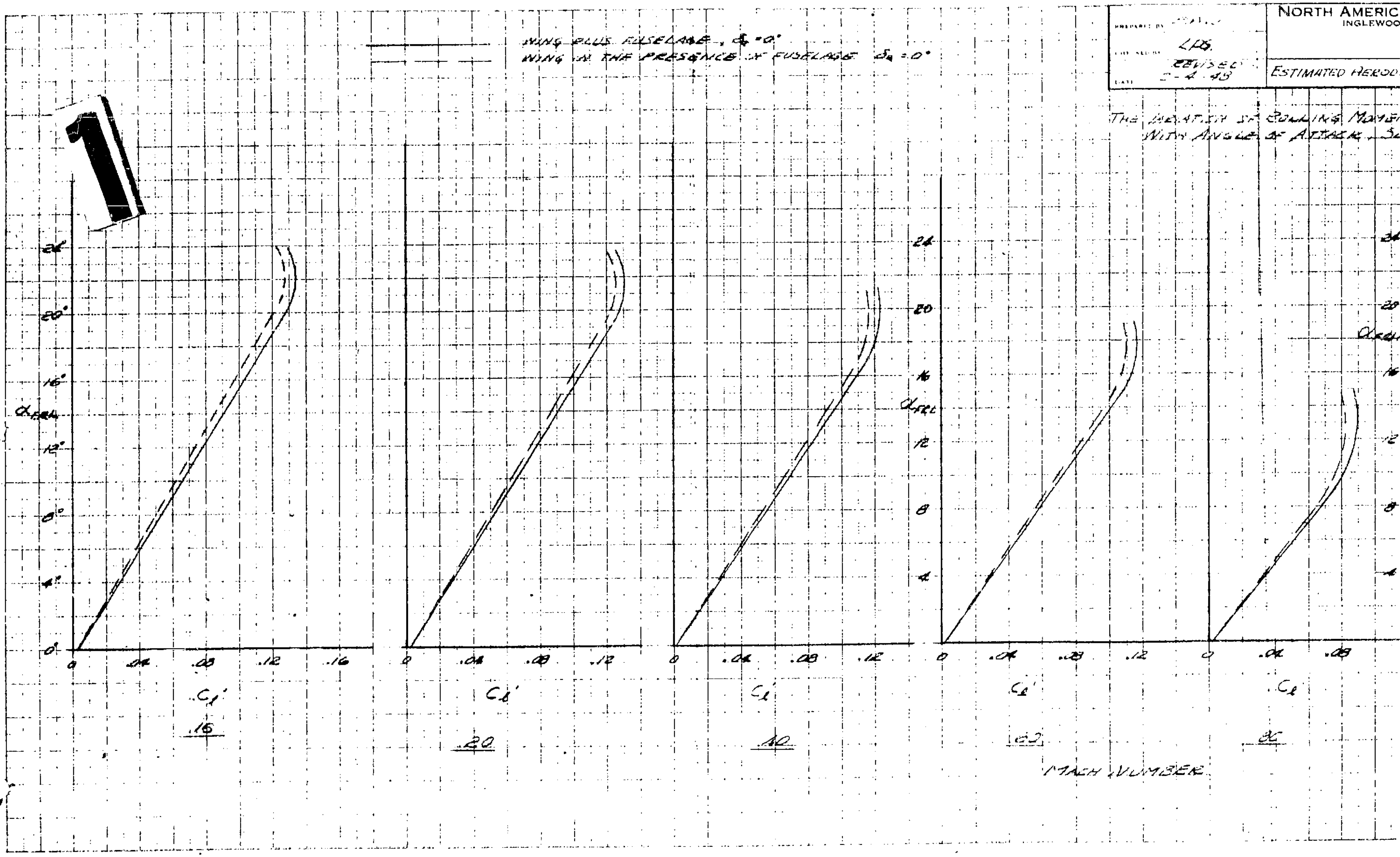


NORTH AMERIC[illegible]
INGLEWOO[illegible]

Checked by LRS.
REVISED 5-4-48

ESTIMATED AERO[illegible]

THE VARIATION OF ROLLING MOMEN[illegible]
WITH ANGLE OF ATTACK, S[illegible]



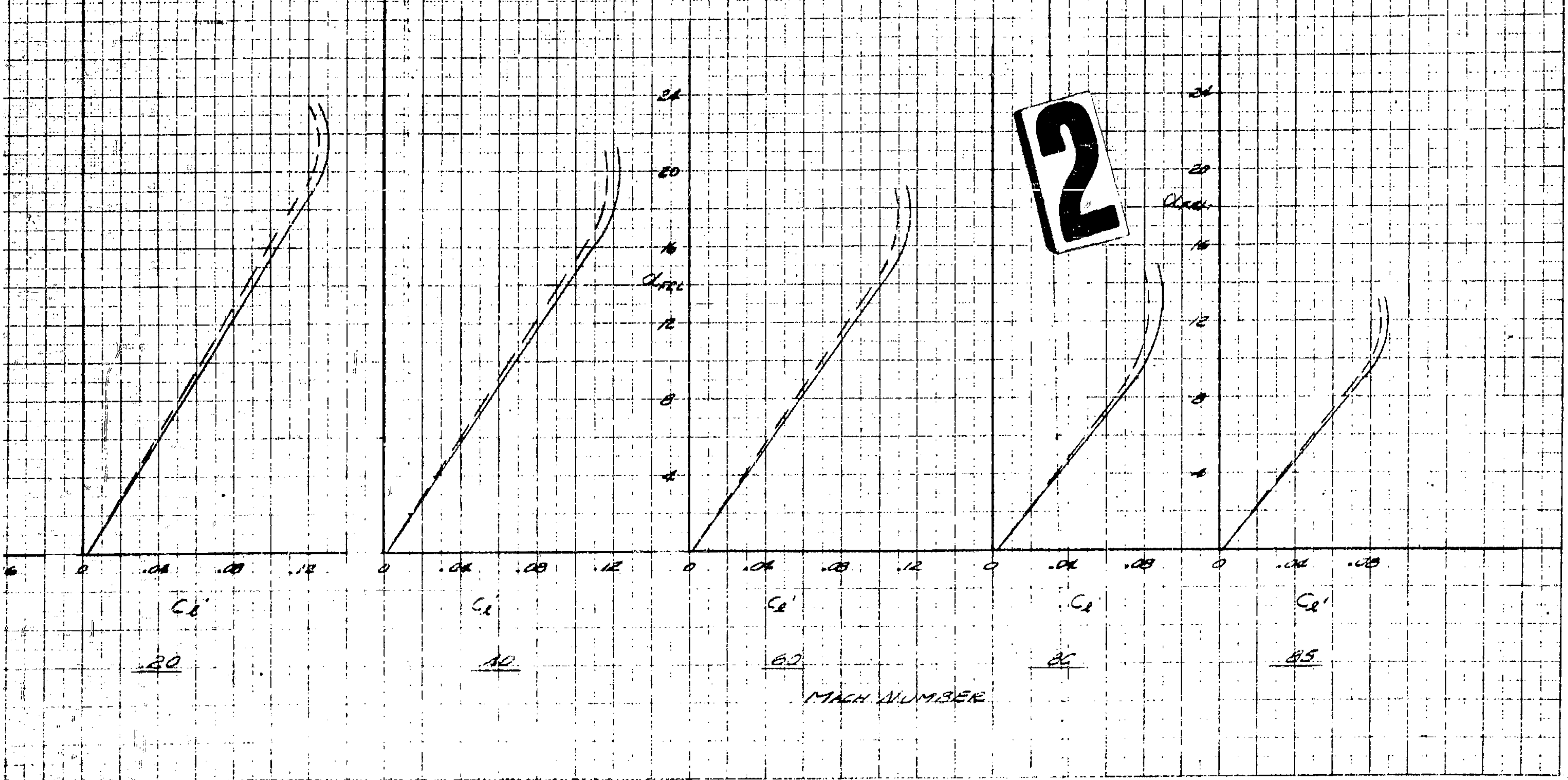
PREPARED BY P.W.J.	NORTH AMERICAN AVIATION, INC. INGLEWOOD, CALIFORNIA	PAGE NO. 70 OF 82
CHECKED BY LPS.		REPORT NO. NA-50-1277
DATE REVISED 2-4-48	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO. F-86E

Fig. 48

THE VARIATION OF ROLLING MOMENT DUE TO LIFT ON LEFT WING WITH ANGLE OF ATTACK, SLATS OPEN

—— WING PLUS FUSELAGE, $\delta_a = 0°$

– – – WING IN THE PRESENCE OF FUSELAGE $\delta_a = 0°$



PREPARED BY O/A	NORTH AMERICAN AVIATION, INC.		PAGE NO 71 OF 82
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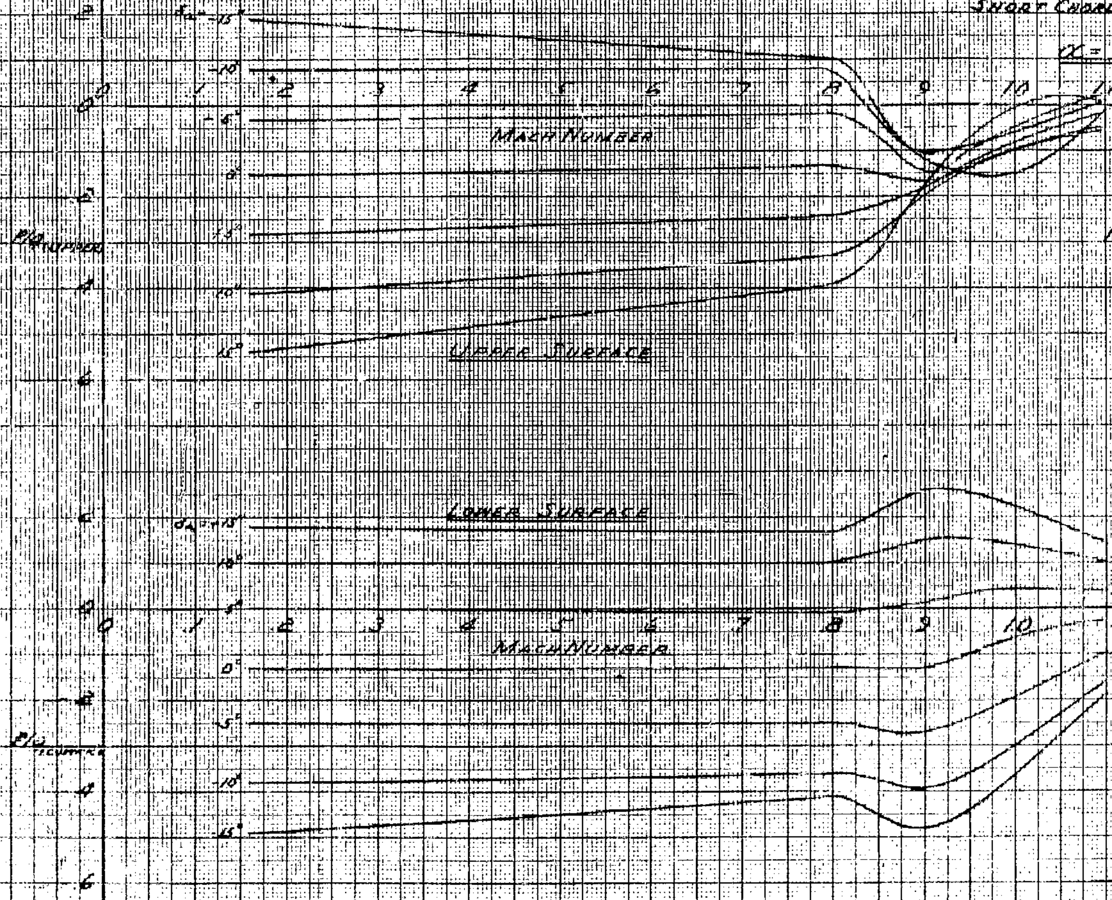
ESTIMATED AILERON PADDLE BALANCE CHAMBER AVERAGE PRESSURE COEFFICIENTS VS. MACH NUMBER
SHORT CHORD AILERON

FIG 49



NOTE: THESE DATA APPLY TO "F-86D", YF-95A AND F-86A AIRPLANES HAVING SHORT CHORD AILERONS

PREPARED BY: DJA	NORTH AMERICAN AVIATION, INC.	PAGE NO. 72 OF 82	
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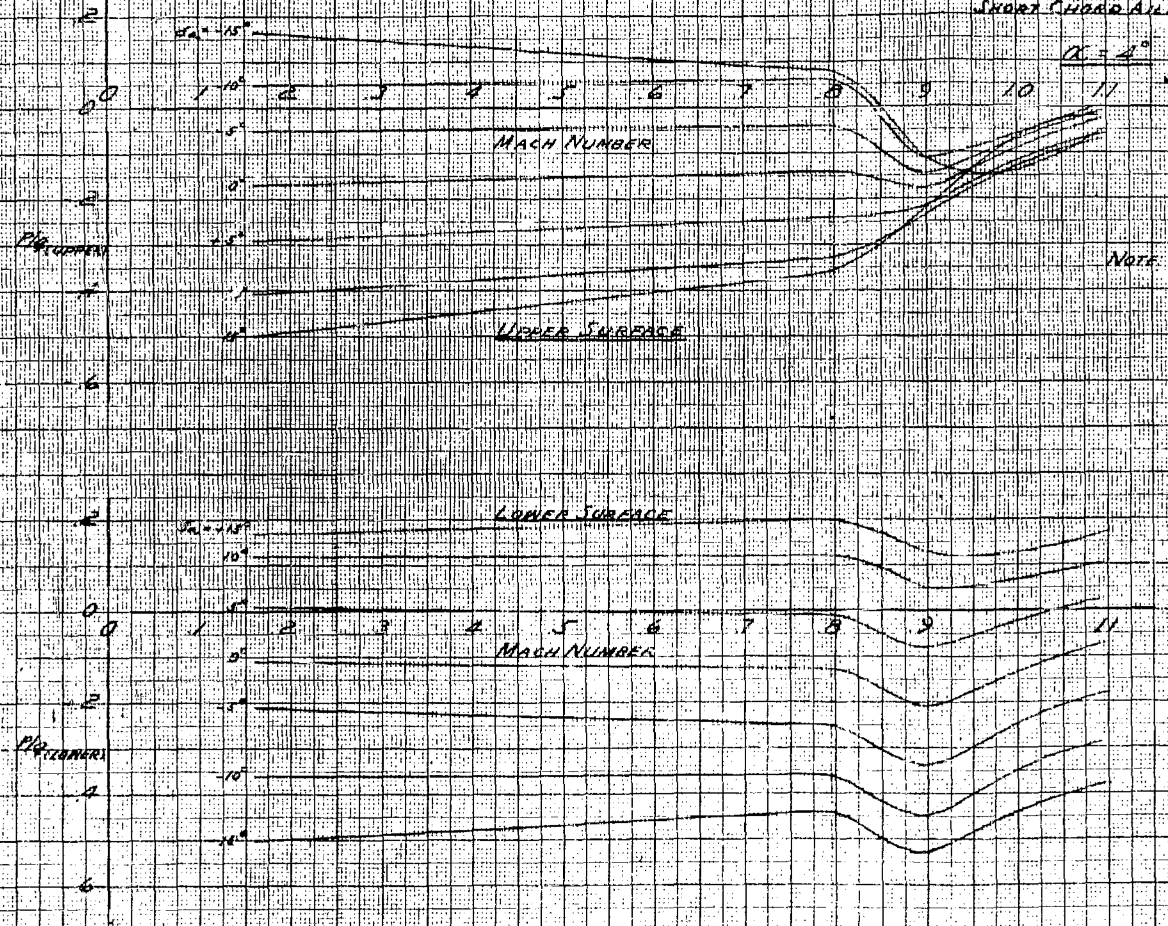
ESTIMATED AILERON PADDLE BALANCE CHAMBER AVERAGE PRESSURE COEFFICIENT VS MACH NUMBER SHORT CHORD AILERON

FIG. 50



NOTE: THESE DATA APPLY TO F-86D, YF-93A AND F-86A AIRPLANES HAVING SHORT CHORD AILERONS.

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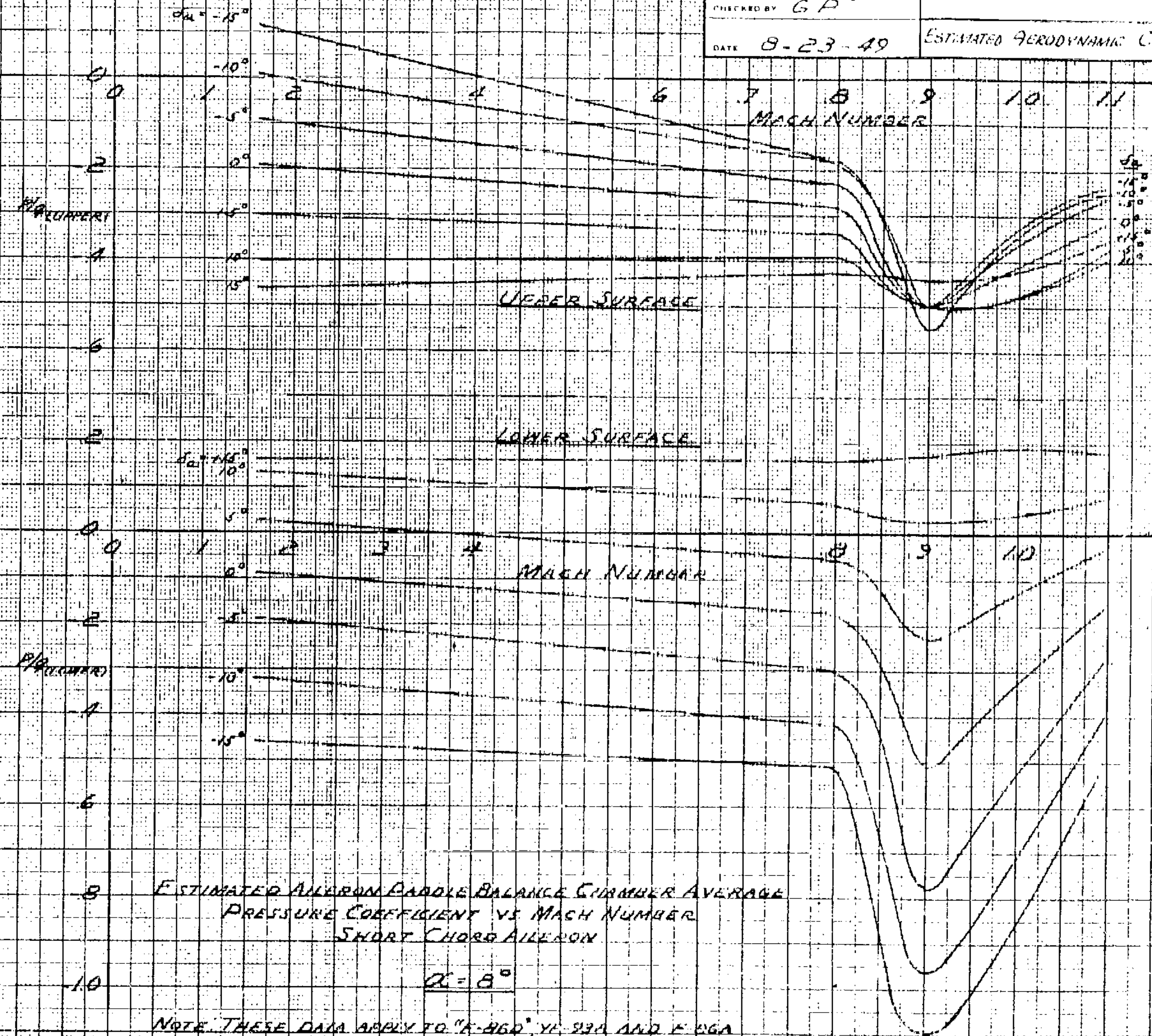
CHECKED BY G.P.		REP. NO. NA-50-1277	
DATE 8-23-49	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL F-86E	

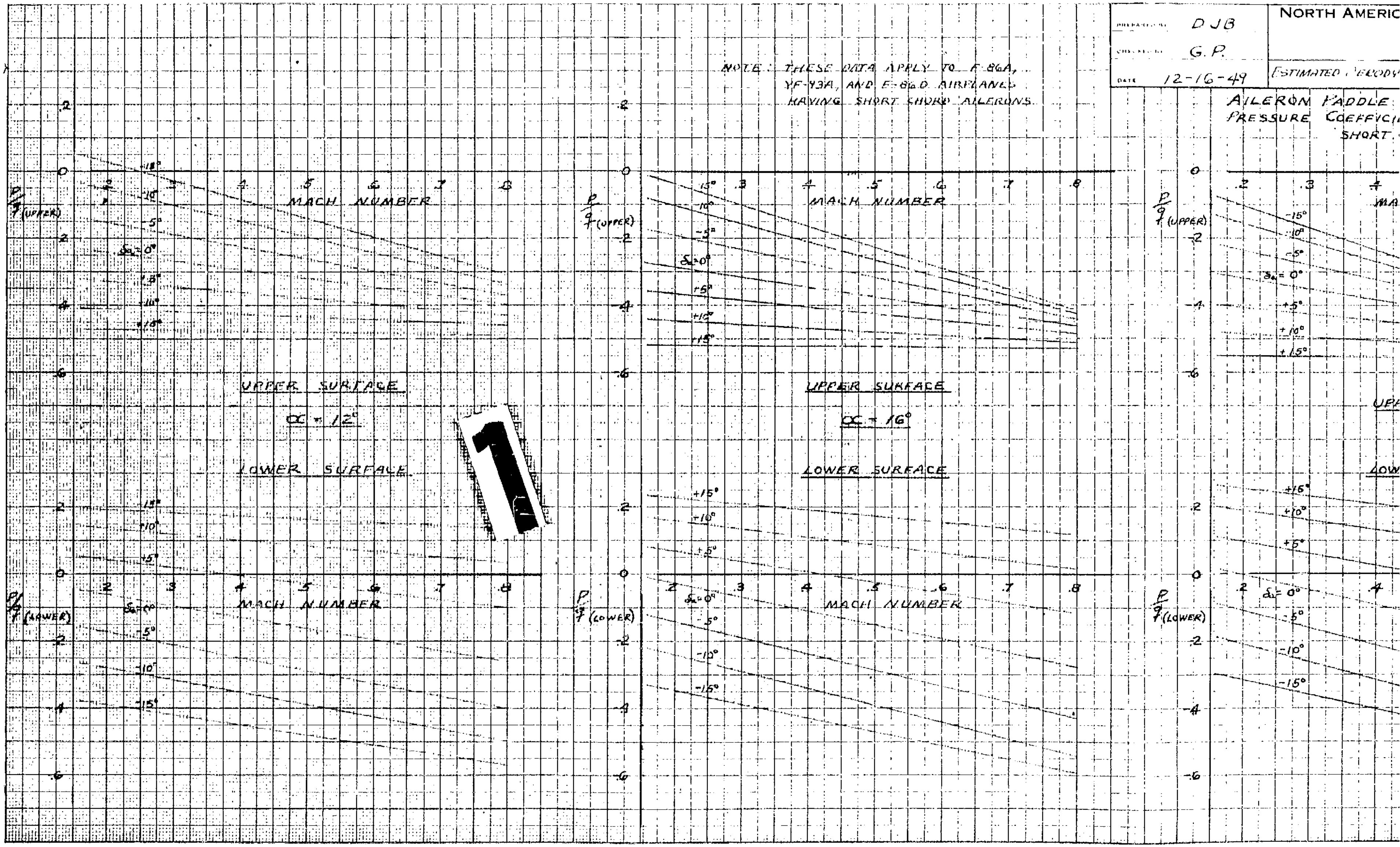
Fig. 51



ESTIMATED AILERON PADDLE BALANCE CHAMBER AVERAGE
PRESSURE COEFFICIENT VS MACH NUMBER
SHORT CHORD AILERON

$\alpha = 8°$

NOTE: THESE DATA APPLY TO "F-86D", YF-93A AND F-86A AIRPLANES HAVING SHORT CHORD AILERONS


DJB
G.P.
12-16-49
NORTH AMERIC
ESTIMATED
AILERON PADDLE
PRESSURE COEFFIC
SHORT
NOTE: THESE DATA APPLY TO F-86A, YF-93A, AND F-86D AIRPLANES HAVING SHORT CHORD AILERONS.
UPPER SURFACE
$\alpha = 12°$
LOWER SURFACE
UPPER SURFACE
$\alpha = 16°$
LOWER SURFACE
MACH NUMBER
$\frac{P}{q}$ (UPPER)
$\frac{P}{q}$ (LOWER)
$\delta_a = 0°$
-5°
-10°
-15°
+5°
+10°
+15°

PREPARED BY	D J B	NORTH AMERICAN AVIATION, INC.	PAGE NO.	74 OF 82
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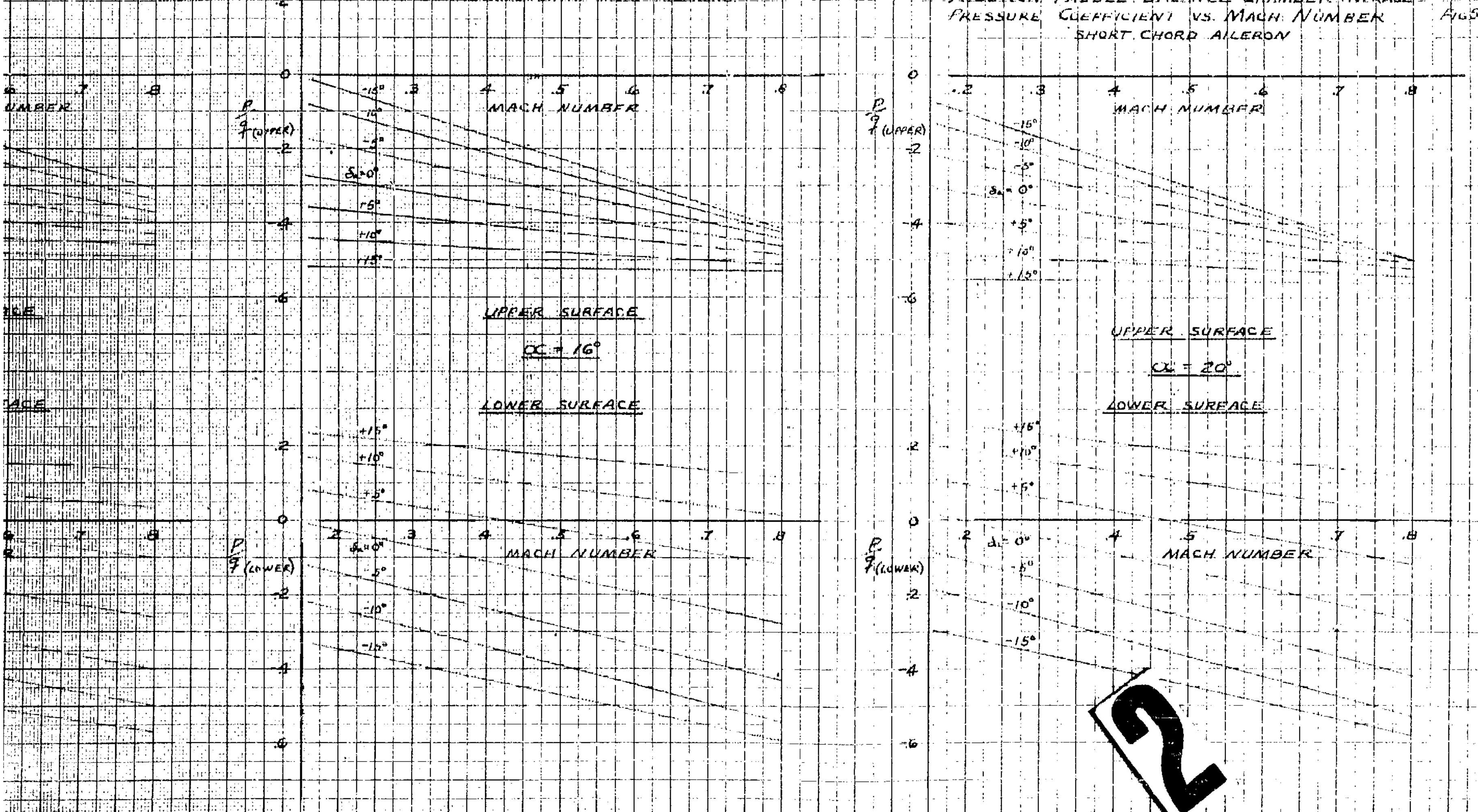
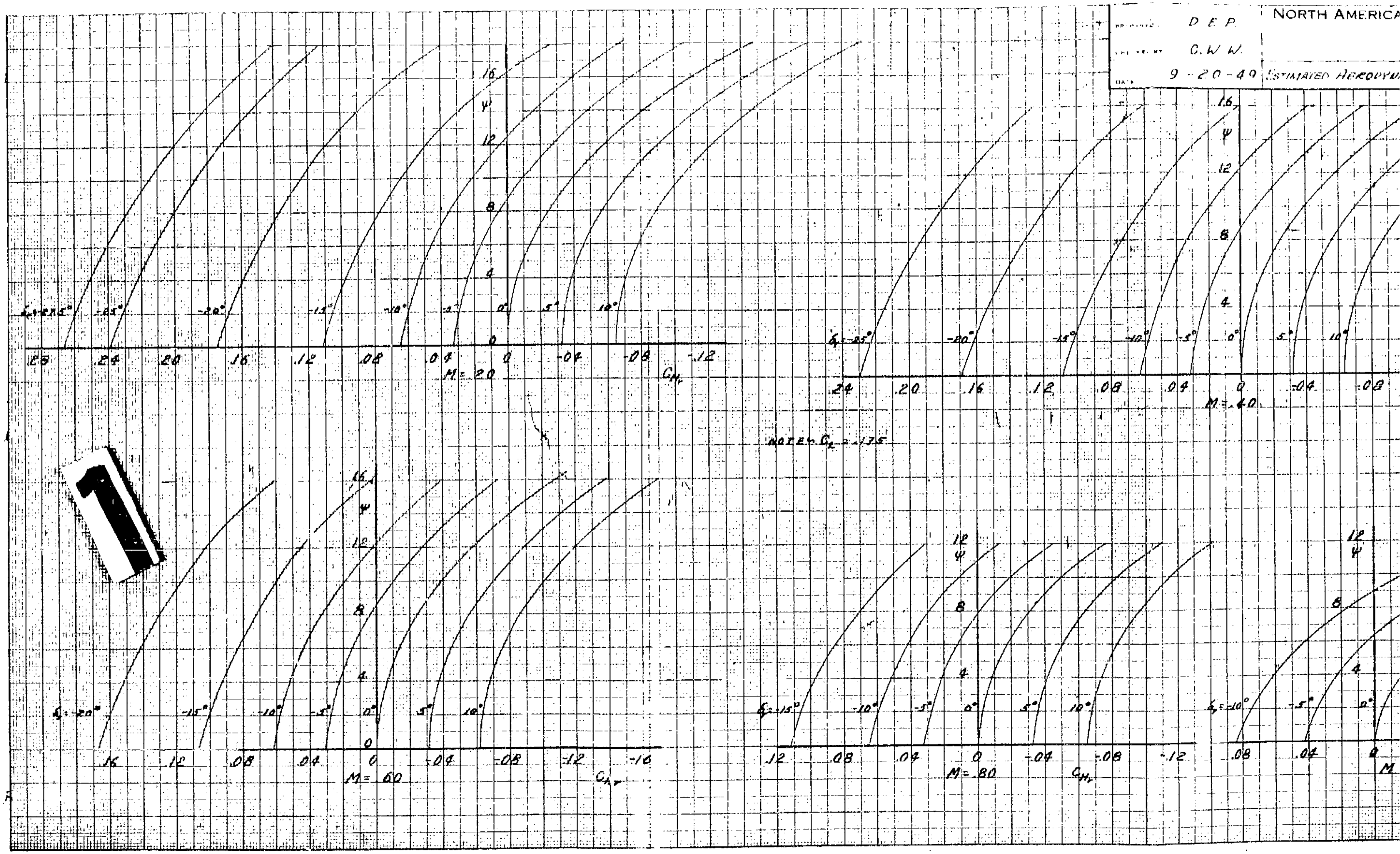
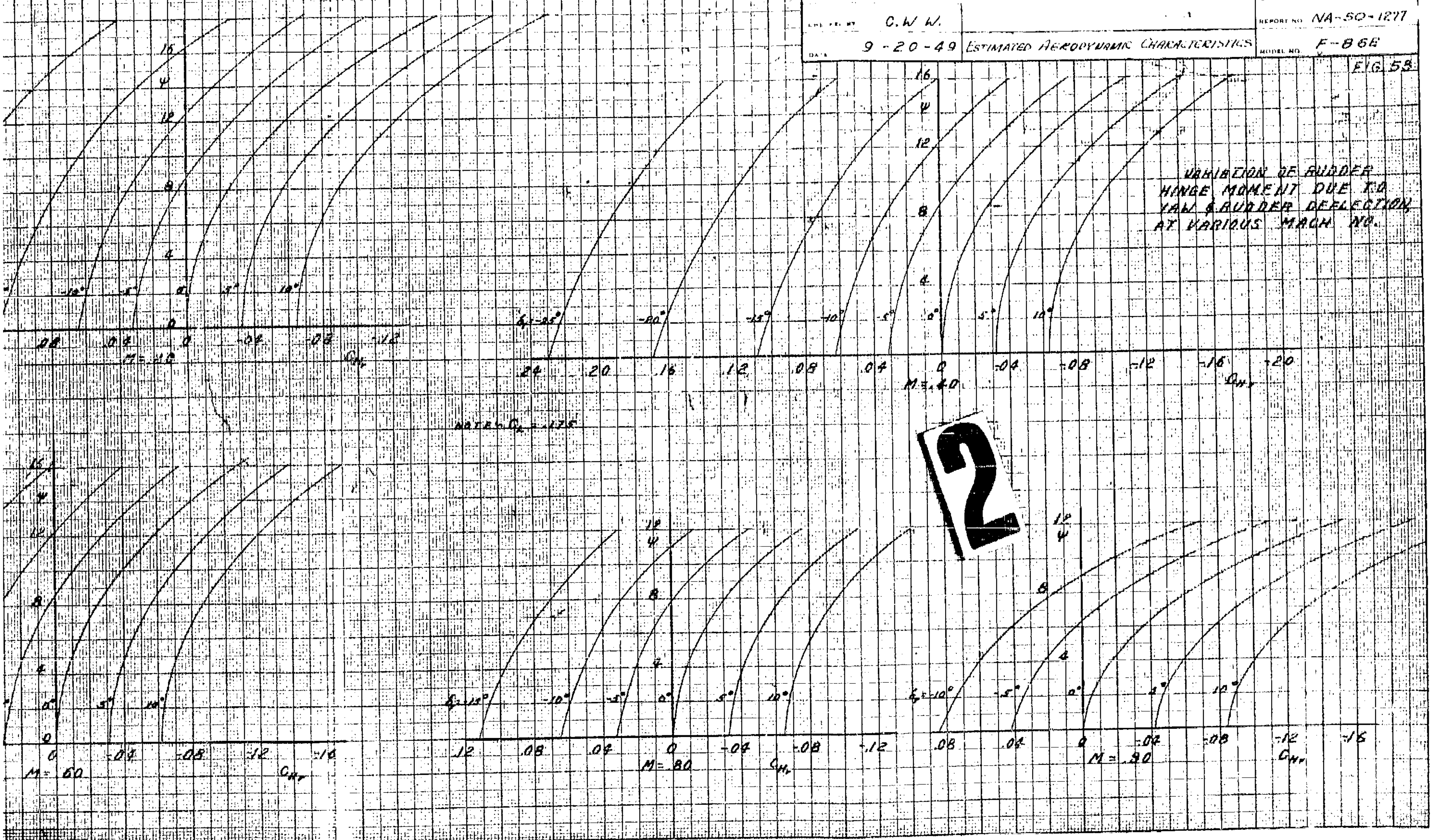
NOTE: THESE DATA APPLY TO F-86A, YF-93A, AND F-86D AIRPLANES HAVING SHORT CHORD AILERONS.

AILERON PADDLE BALANCE CHAMBER AVERAGE PRESSURE COEFFICIENT VS. MACH NUMBER
SHORT CHORD AILERON

FIG 52

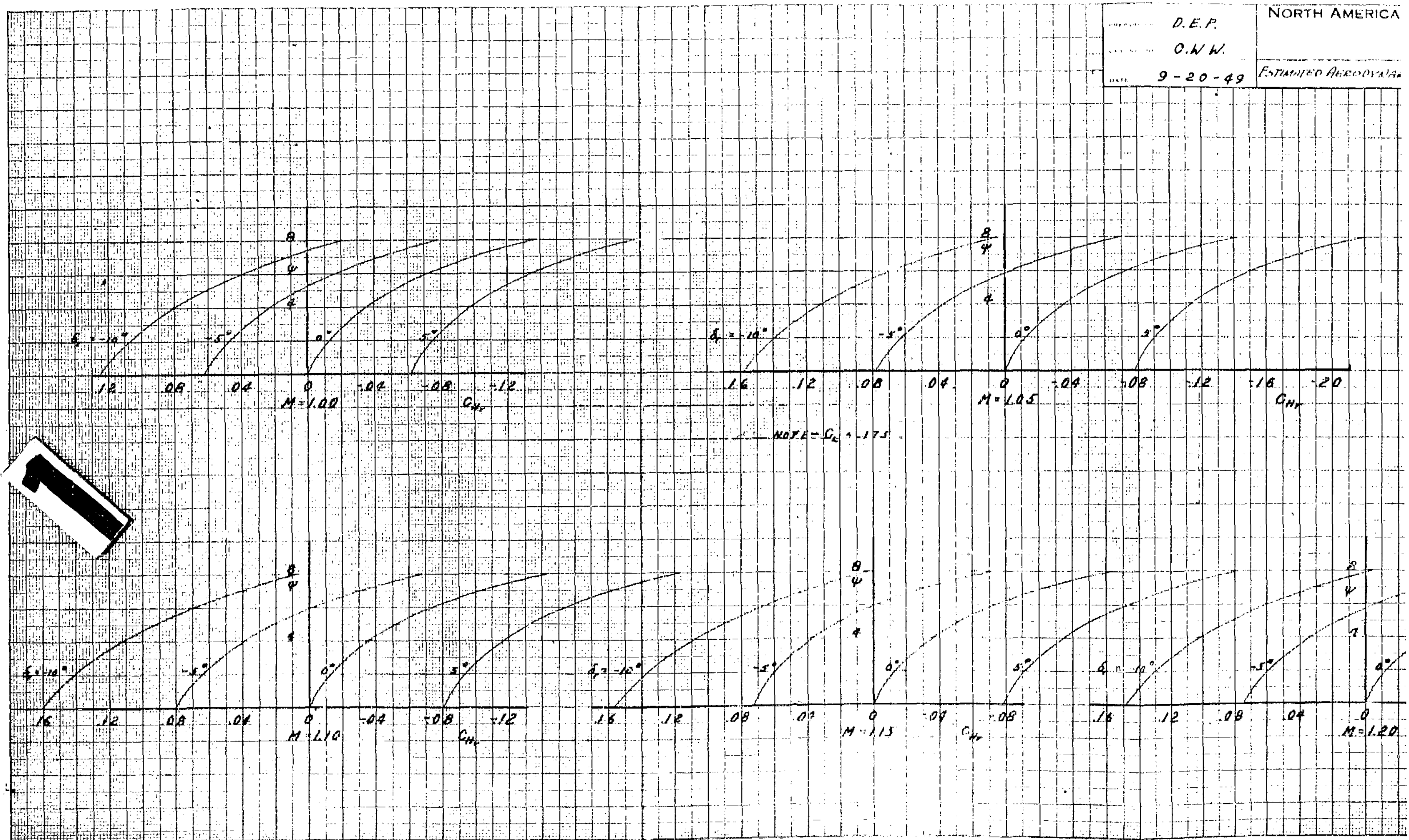



D E P
C. W. W.
9 - 20 - 49
NORTH AMERICA
ESTIMATED AERODYN
M = .20
M = .40
M = .60
M = .80
C_{H_v}
ψ
NOTE: C_L = .175
δ_r = -27.5°
δ_r = -25°
δ_r = -20°
δ_r = -15°
δ_r = -10°



VARIATION OF RUDDER HINGE MOMENT DUE TO YAW & RUDDER DEFLECTION AT VARIOUS MACH NO.
NOTE: C_L = .175
M = .40
M = .60
M = .80
M = .90
C_{H_r}
ψ

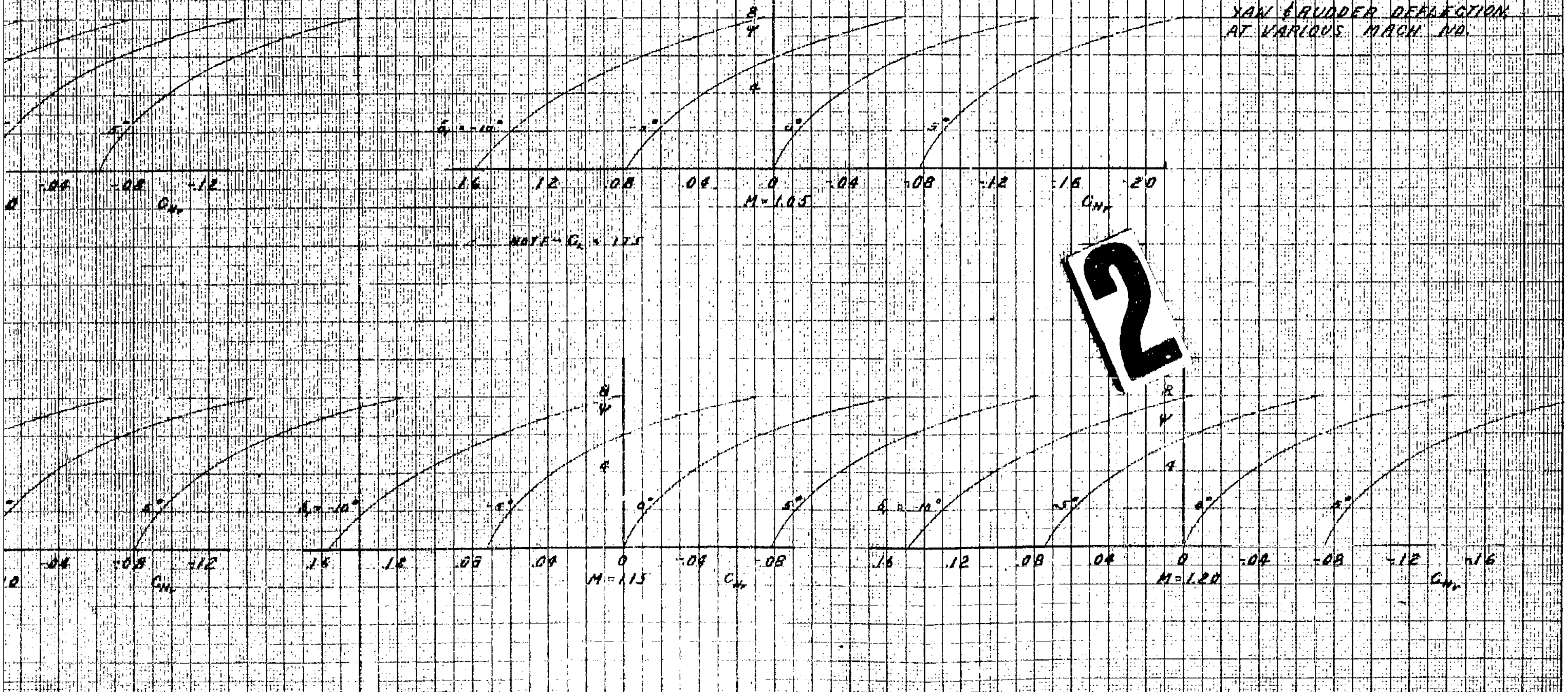
FIG. 53


D.E.P.
O.W.W.
9-20-49
NORTH AMERICA
ESTIMATED AERODYNA
M=1.00
M=1.05
M=1.10
M=1.15
M=1.20
C_{H_r}
NOTE – C_L = .175
δ_r = -10°
-5°
0°
5°
8
ψ
4
.16
.12
.08
.04
0
.04
.08
.12
.16
.20

PREPARED BY: D.E.P.	NORTH AMERICAN AVIATION, INC.		PAGE NO. 76 OF 82
CHECKED BY: O.W.W.			REPORT NO. NA-50-1277
DATE: 9-20-49	ESTIMATED AERODYNAMIC CHARACTERISTICS		MODEL NO. F-86E

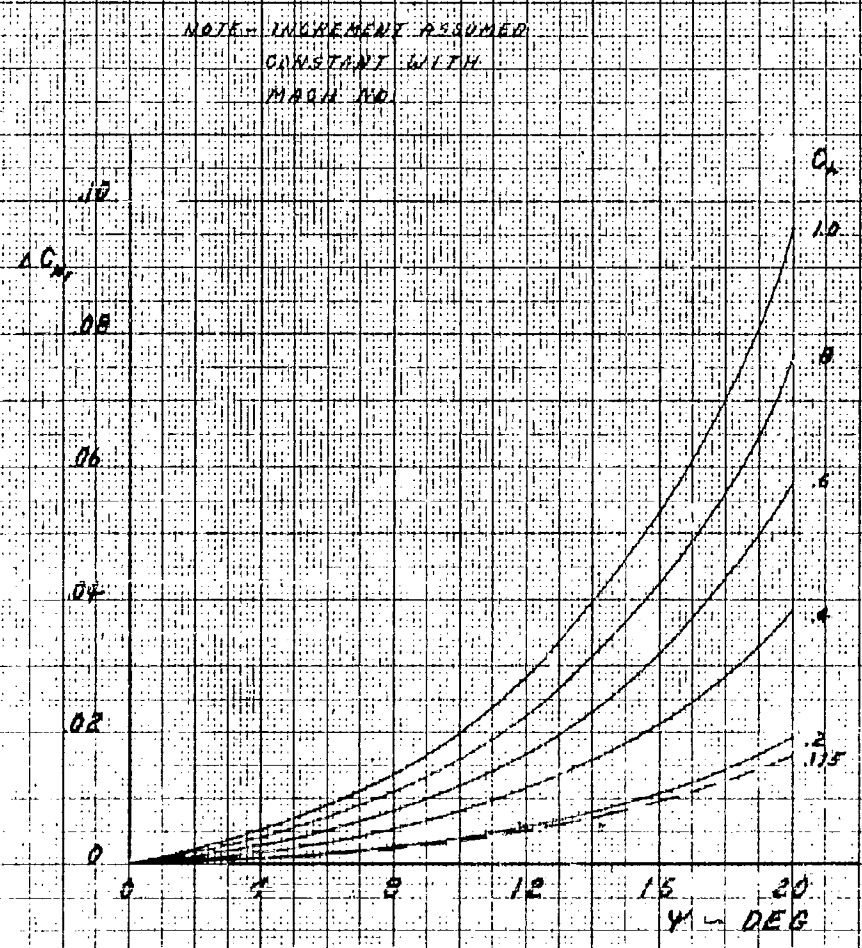
FIG. 54

VARIATION OF RUDDER
HINGE MOMENT DUE TO
YAW & RUDDER DEFLECTION
AT VARIOUS MACH NO.



F19.53

VARIATION OF INCREMENT IN RUDDER HINGE MOMENT DUE TO C_L WITH YAW



Prepared by GP	NORTH AMERICAN AVIATION, INC.	Page No. 78 of 82	
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Date May 8, 1950	ESTIMATED AERODYNAMIC CHARACTERISTICS	Model F-86E	

F-86A

120 GAL EXTERNAL FUEL TANK WITH LARGE* FIN

NORMAL FORCE COEFFICIENT AND CENTER OF PRESSURE

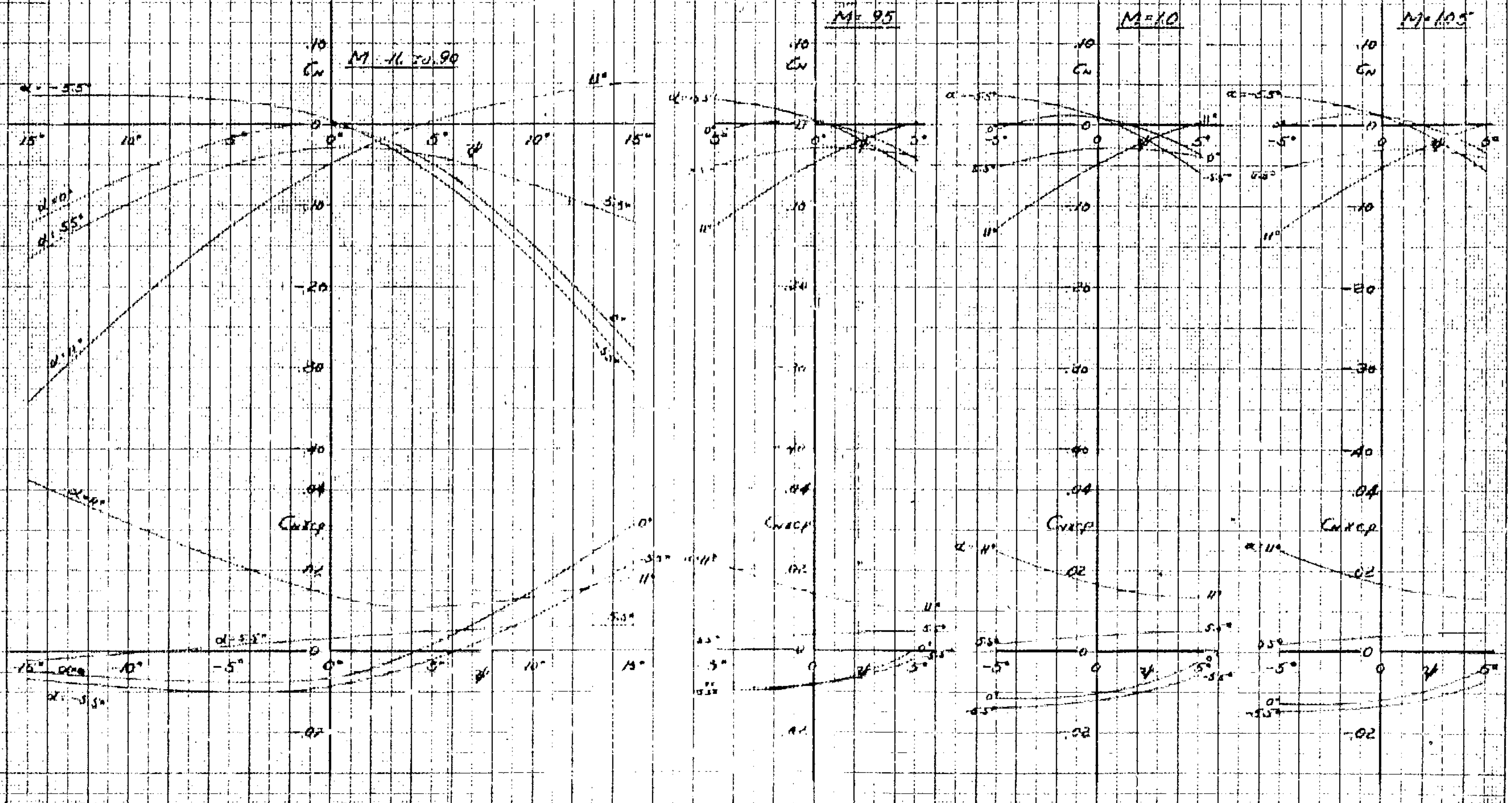
FIG. 56

$C_N = N/qS_p$ WHERE: N = NORMAL FORCE, POSITIVE UP

S_p = PLAN VIEW AREA OF TANK = 16.0 SQ FT

C.P. = LOCATION OF CENTER OF PRESSURE FROM 42% TANK STA. IN TANK LENGTHS (POSITIVE = FWD OF 42%)

ψ = ANGLE OF YAW, α = AIRPLANE ANGLE OF ATTACK



* NOMINAL 600 SQ IN FIN WITH 17° CATHEDRAL

PREPARED BY: G.P.	NORTH AMERICAN AVIATION, INC.	PAGE NO. 79 OF 82
CHECKED BY: WES		REPORT NO. NA-50-1271
DATE: MAY 9, 1950	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO. F-86E

F-86A

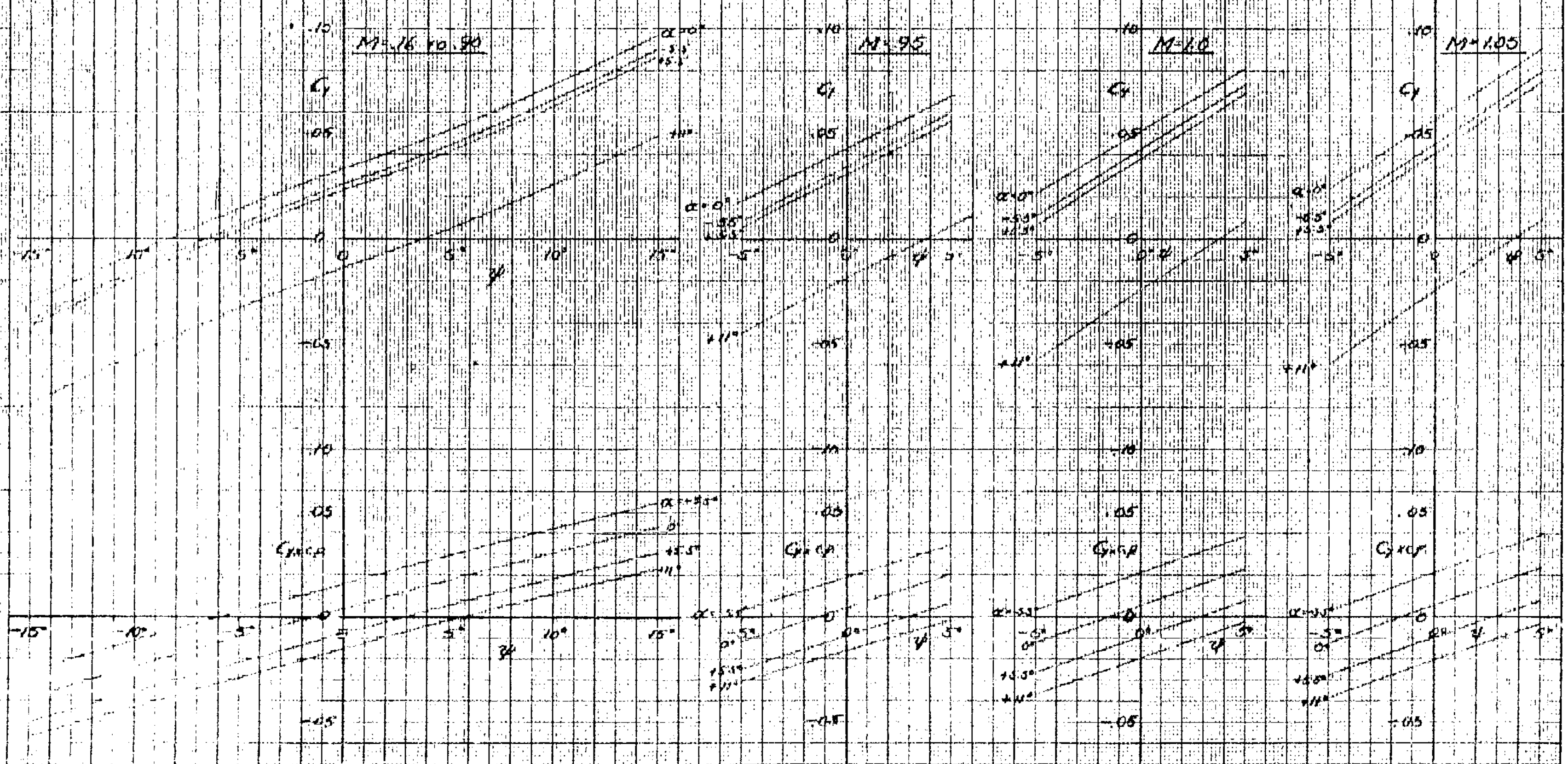
120 GAL EXTERNAL FUEL TANK WITH LARGE* FIN
SIDE FORCE COEFFICIENT AND CENTER OF PRESSURE
LEFT WING TANK ONLY

Fig 57

C_Y = SIDE FORCE COEFFICIENT = Y/qS_p WHERE Y = SIDE FORCE, POSITIVE TO RIGHT
S_p = TANK PLAN VIEW AREA = 16.0 SQ FT

C.P. = LOCATION OF CENTER OF PRESSURE FROM 42% TANK STA. IN TANK LENGTHS (POSITIVE FWD OF 42%)

ψ = ANGLE OF YAW ; α = AIRPLANE ANGLE OF ATTACK



* NOMINAL 500 SQ IN FIN WITH 17° CATHEDRAL

PREPARED BY GP	NORTH AMERICAN AVIATION, INC.	PAGE NO. 80 OF 8?
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FIG. 60

F-86A
120 GAL. EXTERNAL FUEL TANK SUPPORT FAIRING
SUPPORT FAIRING SIDE FORCE SECTION COEFFICIENT AND CENTER OF PRESSURE

LEFT WING TANK ONLY

C_{Y_F} = SECTION SIDE FORCE COEFFICIENT (POSITIVE TOWARD RIGHT) $= \frac{Y_F}{q C_F}$

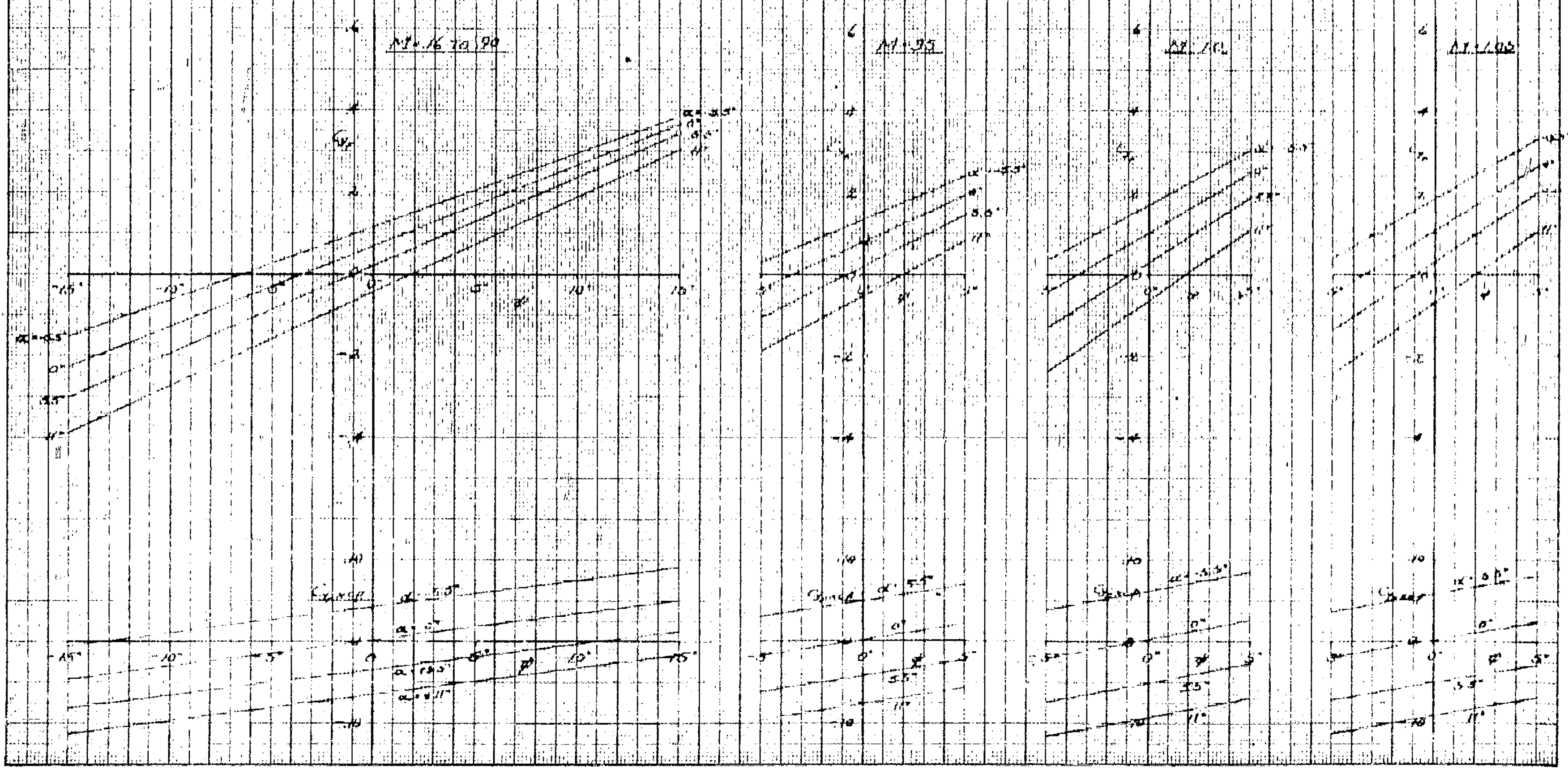
WHERE: Y_F = FAIRING SIDE FORCE (LB/FT) AT W.L. 3?

C_F = FAIRING CHORD = 5.35 FT.

CP = LOCATION OF CENTER OF PRESSURE FROM 42% TANK STA (22.4% FAIRING STA) IN FAIRING CHORDS (POSITIVE FWD. OF 42% TANK STA)

ψ = ANGLE OF YAW

α = AIRPLANE ANGLE OF ATTACK



F-86 TYPE SLAT

TABLE OF RETRACTED SLAT LOAD CHARACTERISTICS AT VARIOUS MACH NO.S AND ANGLES OF ATTACK

		SLAT NO. 1				SLAT NO. 2				SLAT NO. 3			
M	α	C_n	X_n	C_c	Z_c	C_n	X_n	C_c	Z_c	C_n	X_n	C_c	Z_c
.300	-2.1°	-.191	22.4	-.145	10.8	-.249	30.2	-.149	10.4	-.250	28.6	-.115	10.1
	0°	.148	45.6	-.380	-5.6	.138	53.0	-.402	-5.2	.077	48.2	-.430	-3.3
	2.1°	.435	46.0	0	30	.515	43.5	.085	35.8	.460	39.6	.080	37.6
	4.3°	.825	42.0	.166	32.5	.844	42.8	.290	19.4	.784	44.6	.182	18.2
	6.6°	1.281	41.3	.403	22.2	1.304	42.1	.508	14.4	1.360	38.2	.496	19.4
	8.7°	1.591	41.2	.406	18.5	1.535	41.4	.701	13.2	1.598	38.6	.538	12.2
.600	-2.2°	-.193	26.0	-.165	3.9	-.226	27.5	-.152	9.0	-.253	29.5	-.127	9.5
	0°	.140	49.2	-.381	-3.7	.071	56.2	-.409	-1.3	.068	57.4	-.479	-1.3
	2.2°	.583	4.9	.085	16.5	.640	43.4	.126	27.8	.607	41.2	.091	27.0
	4.4°	.963	42.4	.155	38.0	1.129	44.1	.326	18.0	1.032	42.5	.255	17.3
	6.5°	1.345	41.8	.398	23.6	1.578	47.6	.578	15.6	1.555	40.8	.450	16.5
	8.7°	1.911	41.0	.620	20.9	2.240	42.8	.835	13.4	2.066	40.6	.645	13.8
.801	-2.2°	-.127	27.5	-.174	8.7	-.134	26.2	-.154	8.8	-.238	23.2	-.154	8.0
	0°	.162	52.1	-.401	-4.8	.142	53.1	-.478	-4.3	.124	48.8	-.436	-3.3
	2.5°	.571	46.3	.081	[illegible]	.772	47.1	.135	27.8	.738	41.1	.130	19.2
	4.5°	.988	46.2	.112	34.5	1.360	45.8	.302	19.9	1.358	45.8	.265	15.8
	6.7°	1.355	46.5	.316	30.6	1.485	52.1	.424	13.0	1.675	44.0	.346	10.4
	8.9°	1.645	46.6	.377	26.8	1.565	46.6	.583	13.1	1.665	44.9	.616	11.8
.851	0°	.170	58.2	-.404	-6.5	.238	52.4	-.370	-12.4	.234	52.7	-.655	-12.7
	2.3°	.553	48.4	.015	19.8	.700	49.8	.108	36.5	.866	49.8	.112	29.2
	4.5°	.913	46.6	.156	39	1.125	52.1	.278	21.6	1.252	49.8	.212	22.9
	6.7°	1.236	47.5	.228	31.8	1.507	54.2	.385	25.2	1.476	49.8	.235	20.6
	8.8°	1.483	48.2	.347	28.4	1.725	52.3	.488	19.6	1.580	48.6	.532	18.4
.885	0°	.140	57.8	-.116	-5.4	.116	60.7	-.598	-12.2	.142	61.0	-.668	-12.2
	2.3°	.514	49.0	.061	[illegible]	.778	52.1	.188	32.4	.788	51.0	.085	34.7
	4.5°	.855	47.5	.161	43.9	1.127	52.5	.228	25.5	1.105	52.2	.180	25.0
	6.7°	1.111	47.8	.191	34.6	1.398	52.5	.315	20.8	1.312	50.0	.228	22.1
	9.0°	1.380	48.5	.277	29.8	1.591	56.6	.378	20.0	1.420	48.6	.276	21.0
.903	-2.3°	-.112	25.0	-.166	8.1	-.158	26.0	-.124	5.8	-.152	20.8	-.156	5.6
	-0.1°	.155	58.7	-.404	-4.2	.304	54.0	-.477	-8.6	.214	51.3	-.167	-8.4
	2.5°	.487	47.2	-.031	-13.8	[illegible]	48.7	.080	43.8	.652	48.5	.155	43.4
	4.5°	.759	46.9	.081	[illegible]	1.245	52.3	.180	31.5	.968	46.9	.16	26.8
	6.4°	1.068	47.2	[illegible]	35.6	1.320	52.8	.342	21.1	1.225	40.7	.205	23.0

C_n = Force Coefficient Perpendicular to WRP, Positive Upward.
X_n = Distance of C.P. Aft of Slat L.E., Measured Parallel to WRP, Per Cent Slat Chord.
C_c = Force Coefficient Parallel to WRP, Positive Forward.
Z_c = Distance of C.P. Above WRP, Per Cent Slat Chord.

Note – Tabulated Data Result from Integration of Slat Pressure Distributions Obtained from Tests of ⅛ Scale Model, CWT Rep. # 23.

100% Slat Chord = 13 in. Full Scale.

C_n, C_c = F/Sq, Where S = Slat Area Projected on WRP.
M = Test Mach Number.
α = Model Angle of Attack Tunnel Corrected.

NORTH AMERICAN AVIATION, INC.

Prepared by: D.E.P. Checked by: P.S.I. Date: 6-20-50

Page No. 81 of 82 Report No. NA-50-1211 Model No. F-86E

PREPARED BY: D.E.P.	NORTH AMERICAN AVIATION, INC.	PAGE NO. 82 OF 82
CHECKED BY: P. S. T.		REPORT NO. NA-50-1277
DATE: 6-20-50	ESTIMATED AERODYNAMIC CHARACTERISTICS	MODEL NO. F-86E

FIG. 60

SLAT OPENING FORCE COEFFICIENT, C_S, VS ANGLE OF ATTACK FOR VARIOUS MACH NOS AND SLATS

SLATS FULLY RETRACTED

SLAT TRACK "B"

C_S CALCULATIONS BASED ON THE FOLLOWING SLAT ROLLER TRACK DIMENSIONS:

RADIUS, R_R 32.856 IN.
CENTER OF ROTATION
AFT OF L.E., X_R 15.800 IN.
BELOW WRP, Z_R 32.000 IN.

$$C_S = \frac{C_n(X_n - X_R) + C_c(Z_c + Z_R)}{R_R}$$

C_n, C_c, X_n, Z_c OBTAINED FROM PRESSURE DISTRIBUTION DATA OF 1/9 SCALE MODEL, CWT REP. #28

MACH NO.	SYMBOL
.300	○
.600	△
.801	□
.851	◇
.882	▽
.903	▯

$$C_S = \frac{F}{Sq} = f(\alpha)$$

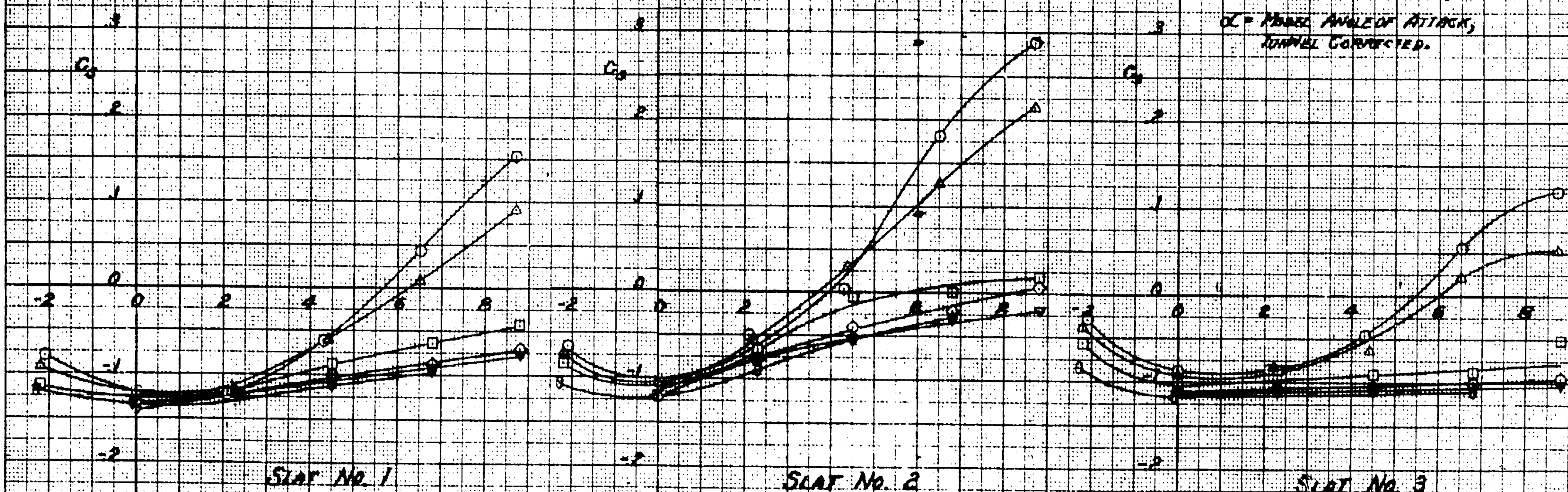
WHERE:

F = TOTAL FORCE ACTING TANGENTIALLY TO ℄ OF TRACK ROLLERS, LBS. (POSITIVE WHEN TENDING TO EXTEND SLAT)

S = TOTAL AREA OF SLAT AS PROJECTED IN WRP, FT.²

q = DYNAMIC PRESSURE, LBS/FT.²

α = MODEL ANGLE OF ATTACK, TUNNEL CORRECTED.



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

FEB 19 2002

MEMORANDUM FOR DTIC/OCQ (ZENA ROGERS)
8725 JOHN J. KINGMAN ROAD, SUITE 0944
FORT BELVOIR VA 22060-6218

FROM: AFMC CSO/SCOC
4225 Logistics Avenue, Room S132
Wright-Patterson AFB OH 45433-5714

SUBJECT: Technical Reports Cleared for Public Release

References: (a) HQ AFMC/PAX Memo, 26 Nov 01, Security and Policy Review, AFMC 01-242 (Atch 1)

(b) HQ AFMC/PAX Memo, 19 Dec 01, Security and Policy Review, AFMC 01-275 (Atch 2)

(c) HQ AFMC/PAX Memo, 17 Jan 02, Security and Policy Review, AFMC 02-005 (Atch 3)

1. Technical reports submitted in the attached references listed above are cleared for public release in accordance with AFI 35-101, 26 Jul 01, *Public Affairs Policies and Procedures*, Chapter 15 (Cases AFMC 01-242, AFMC 01-275, & AFMC 02-005).

2. Please direct further questions to Lezora U. Nobles, AFMC CSO/SCOC, DSN 787-8583.

Lezora U. Nobles

LEZORA U. NOBLES
AFMC STINFO Assistant
Directorate of Communications and Information

Attachments:
1. HQ AFMC/PAX Memo, 26 Nov 01
2. HQ AFMC/PAX Memo, 19 Dec 01
3. HQ AFMC/PAX Memo, 17 Jan 02

cc:
HQ AFMC/HO (Dr. William Elliott)

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

JAN 17 2002

MEMORANDUM FOR HQ AFMC/HO

FROM: HQ AFMC/PAX

SUBJECT: Security and Policy Review, AFMC 02-005

1. The reports listed in your attached letter were submitted for security and policy review IAW AFI 35-101, Chapter 15. They have been cleared for public release.

2. If you have any questions, please call me at 77828. Thanks.

James A. Morrow
JAMES A. MORROW
Security and Policy Review
Office of Public Affairs

Attachment:
Your Ltr 14 January 2002

14 January 2002

MEMORANDUM FOR: HQ AFMC/PAX
Attn: Jim Morrow

FROM: HQ AFMC/HO

SUBJECT: Releasability Reviews

1. Please conduct public releasability reviews for the following attached Defense Technical Information Center (DTIC) reports:

   a. *Flight Test Program for Model P-86 Airplane Class – Jet Propelled Fighter*, 2 December 1946; DTIC No. AD-B804 069.

   b. *Physiological Recognition of Strain in Flying Personnel: Eosinopenia in F-86 Combat Operations*, September 1953; DTIC No. AD- 020 375.

   c. *Phase IV Performance Test of the F-86F-40 Airplane Equipped with 6x3-inch Leading Edge Slats and 12-inch Extensions on the Wing Tips*, May 1956; DTIC No. AD- 096 084.

   d. *F-86E Thrust Augmentation Evaluation*, March 1957; DTIC No. AD- 118 703.

   e. *F-86E Thrust Augmentation Evaluation*, Appendix IV, March 1957; DTIC No. AD- 118 707.

   f. *A Means of Comparing Fighter Effectiveness in the Approach Phase*, October 1949; DTIC No. AD- 223 596.

   g. *War Emergency Thrust Augmentation for the J47 Engine in the F-86 Aircraft*, August 1955; DTIC No. AD- 095 757.

   h. *Operational Suitability Test of the F-86F Airplane*, 4 May 1953; DTIC No. AD- 017 568.

   i. *Estimated Aerodynamic Characteristics for Design of the F-86E Airplane*, 26 December 1950; DTIC No. AD- 069 271.

   j. *Combat Suitability Test of F-86F-2 Aircraft with T-160 Guns*, August 1953; DTIC No. AD- 019 725.

2. These attachments have been requested by Dr. Kenneth P. Werrell, a private researcher.

3. The AFMC/HO point of contact for these reviews is Dr. William Elliott, who may be reached at extension 77476.

John D. Weber
JOHN D. WEBER
Command Historian

10 Attachments:
a. DTIC No. AD-B804 069
b. DTIC No. AD- 020 375
c. DTIC No. AD- 096 084
d. DTIC No. AD- 118 703
e. DTIC No. AD- 118 707
f. DTIC No. AD- 223 596
g. DTIC No. AD- 095 757
h. DTIC No. AD- 017 568
i. DTIC No. AD- 069 271
j. DTIC No. AD- 019 725